T06020 "68562260

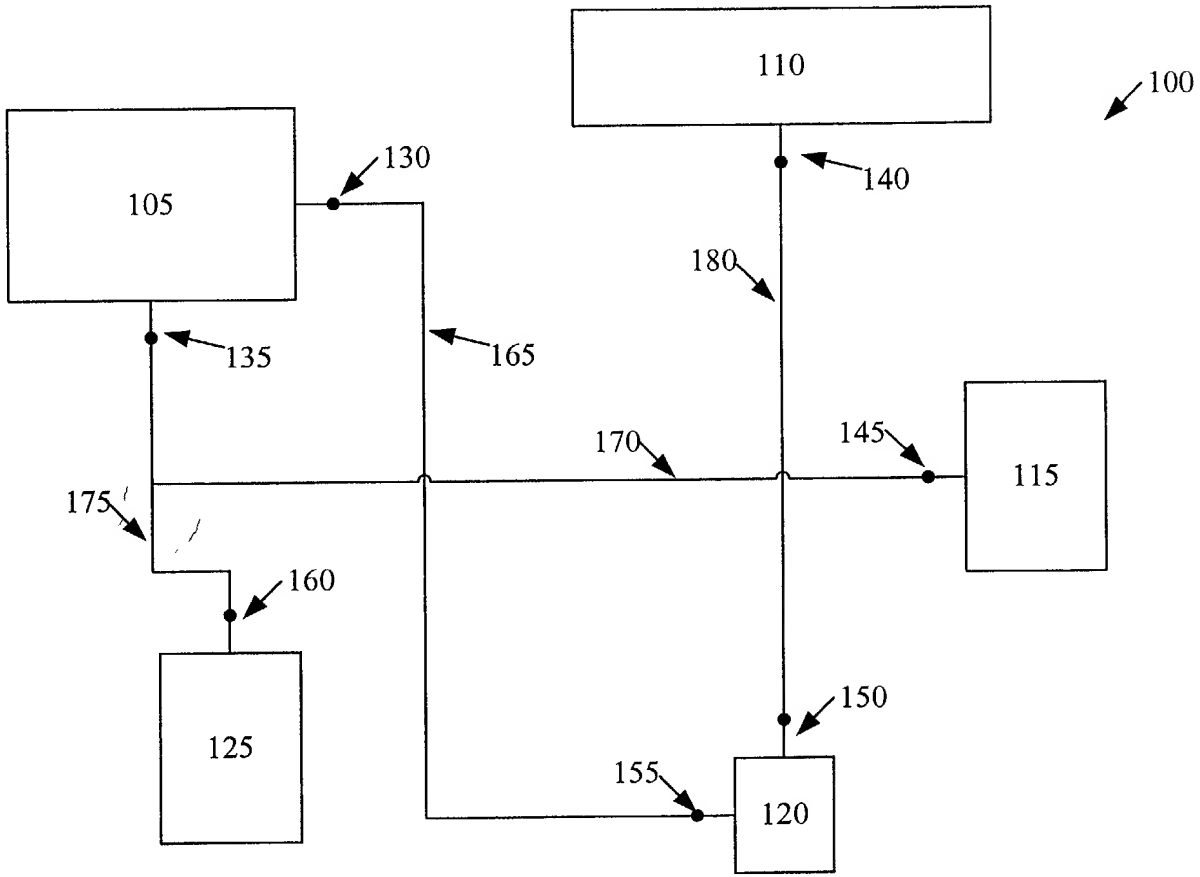

Figure 1

T06020" 68562260

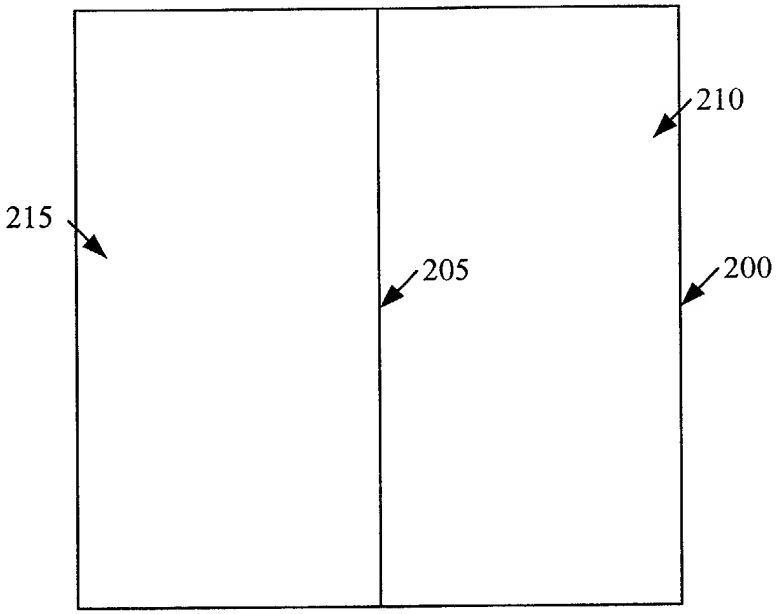

Figure 2

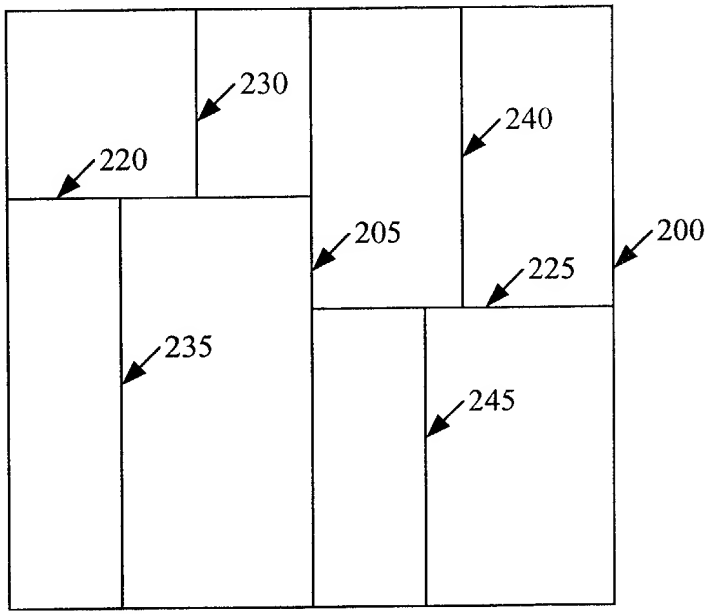

Figure 3

T0607D" 68568260

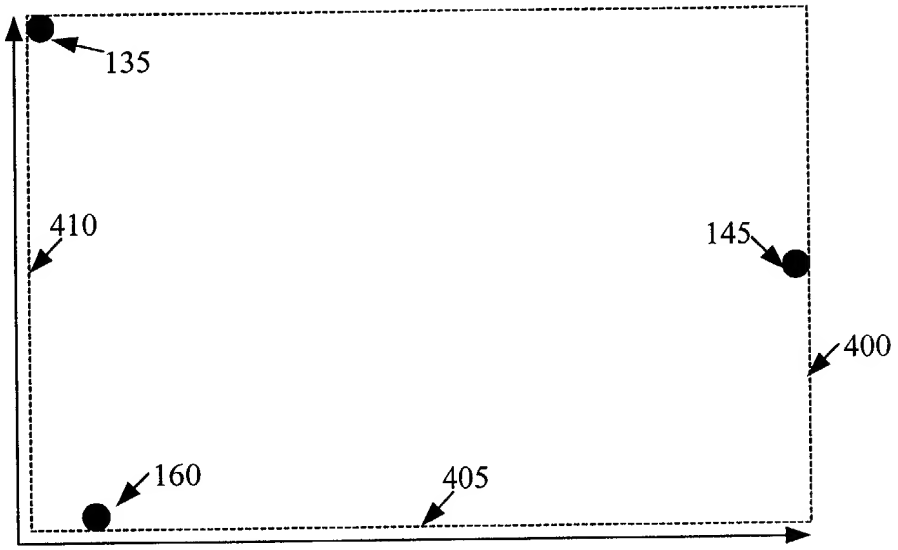

Figure 4

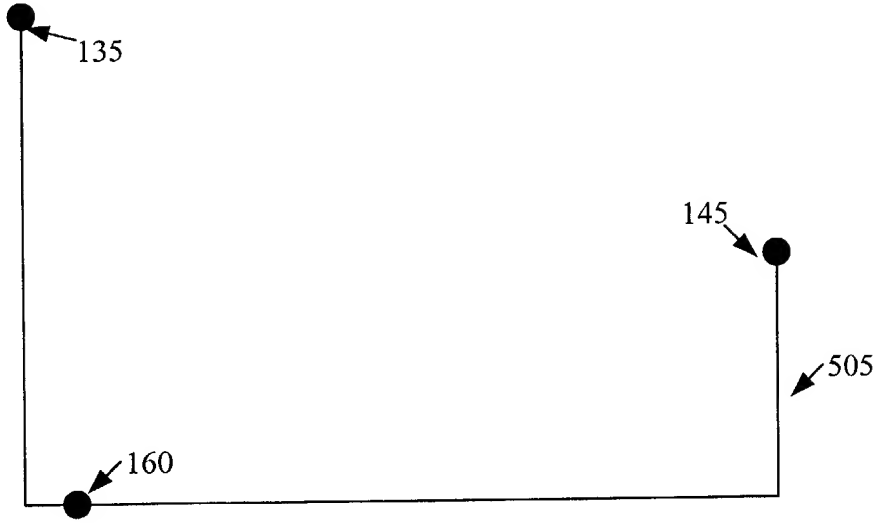

Figure 5

TD60Z0" 6856E260

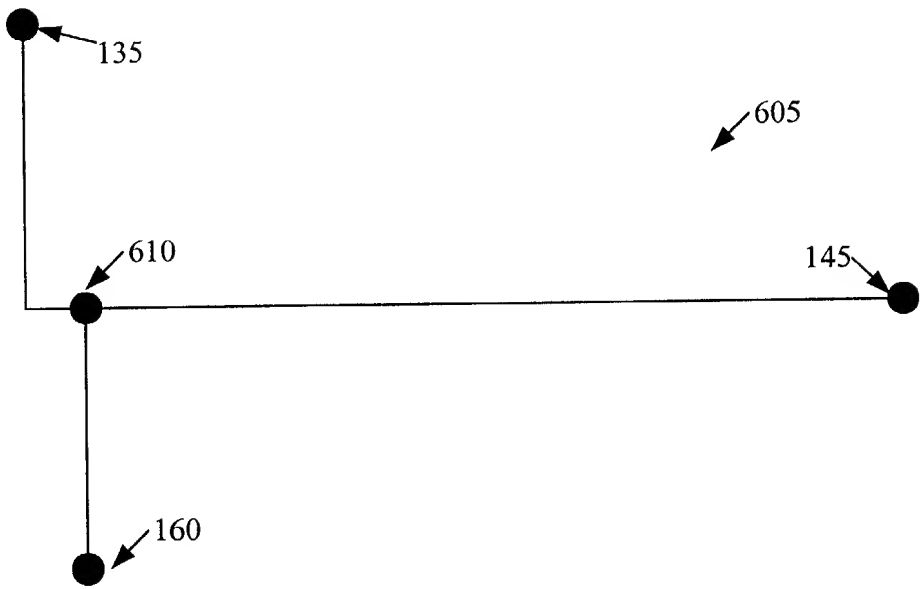

Figure 6

T0602D "6856260

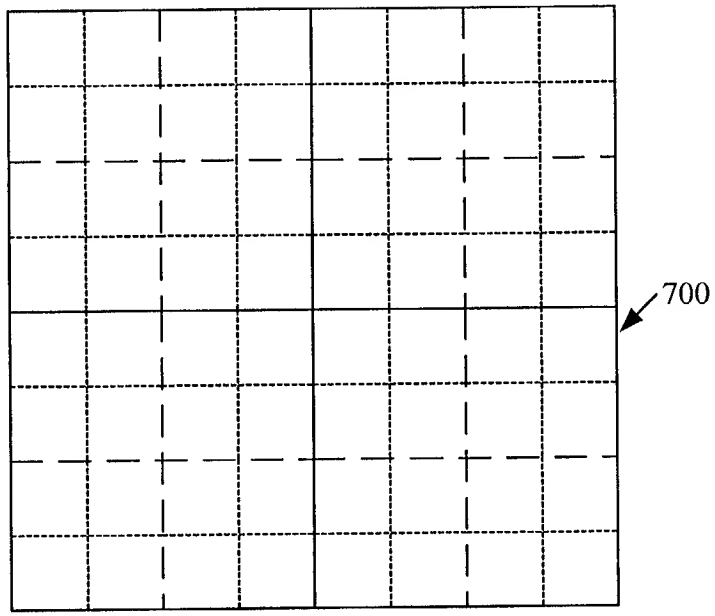

Figure 7

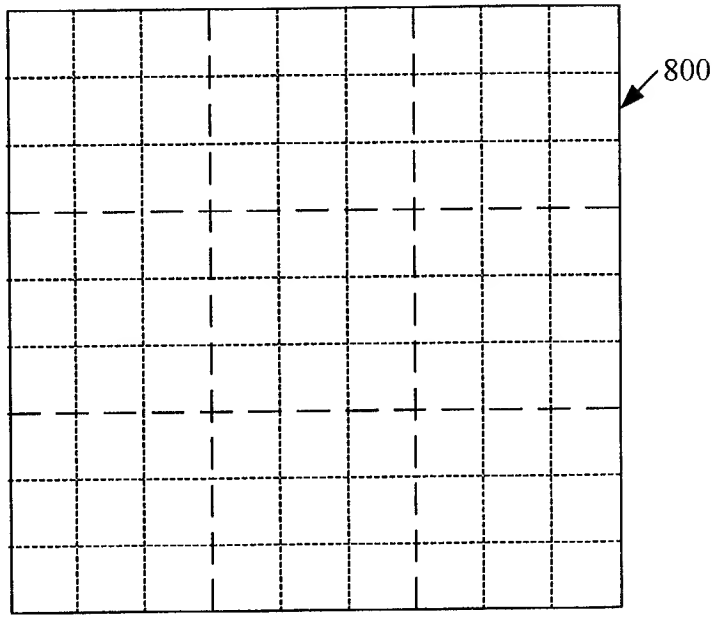

Figure 8

T0602D" 6856260

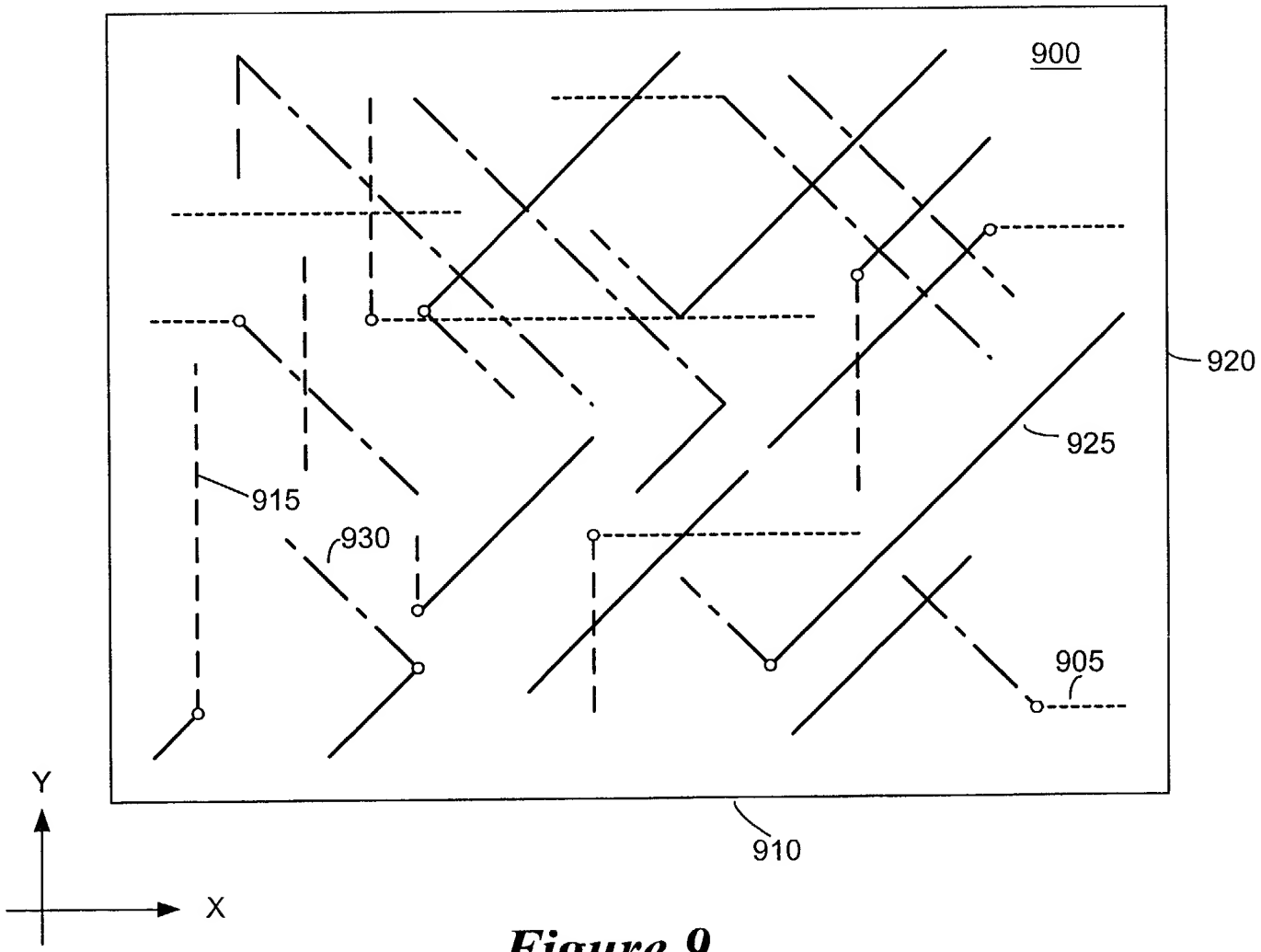

Figure 9

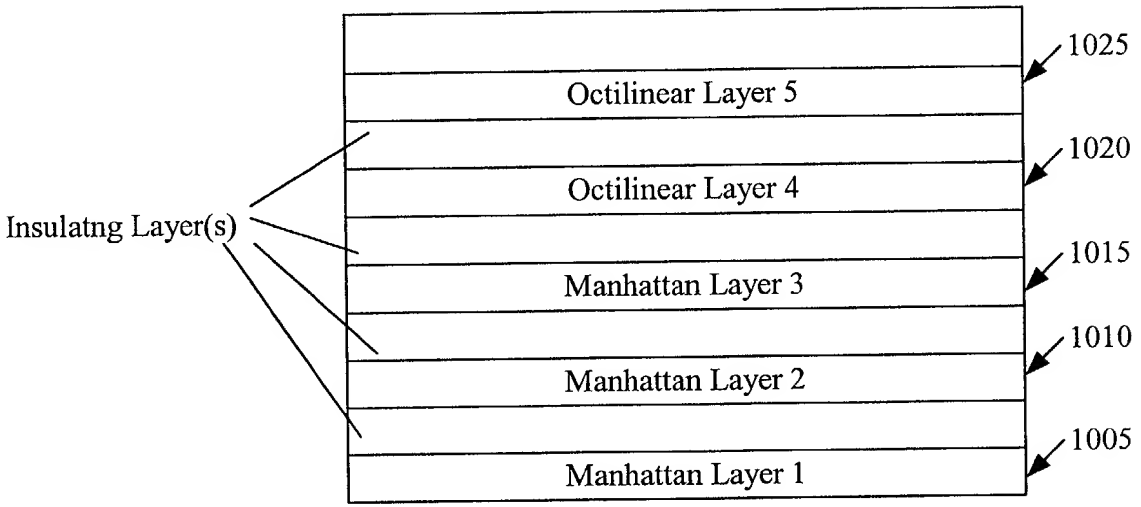
Octilinear Layer 5
Octilinear Layer 4
Manhattan Layer 3
Manhattan Layer 2
Manhattan Layer 1
Insulatng Layer(s)
1025
1020
1015
1010
1005

Figure 10

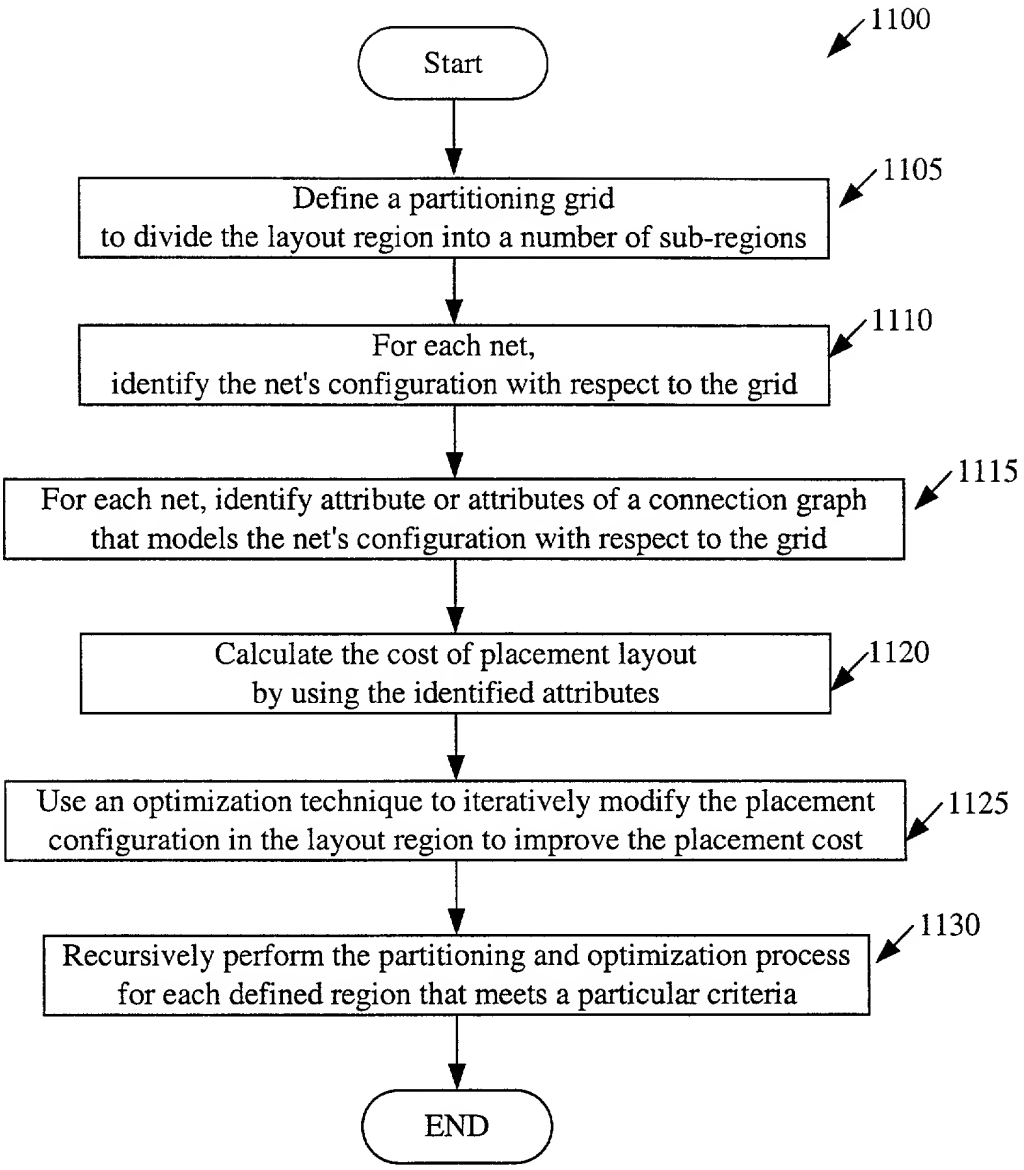
1100
Start
1105
Define a partitioning grid
to divide the layout region into a number of sub-regions
1110
For each net,
identify the net's configuration with respect to the grid
1115
For each net, identify attribute or attributes of a connection graph
that models the net's configuration with respect to the grid
1120
Calculate the cost of placement layout
by using the identified attributes
1125
Use an optimization technique to iteratively modify the placement
configuration in the layout region to improve the placement cost
1130
Recursively perform the partitioning and optimization process
for each defined region that meets a particular criteria
END

Figure 11

TO60ZD" 68S6EZ60

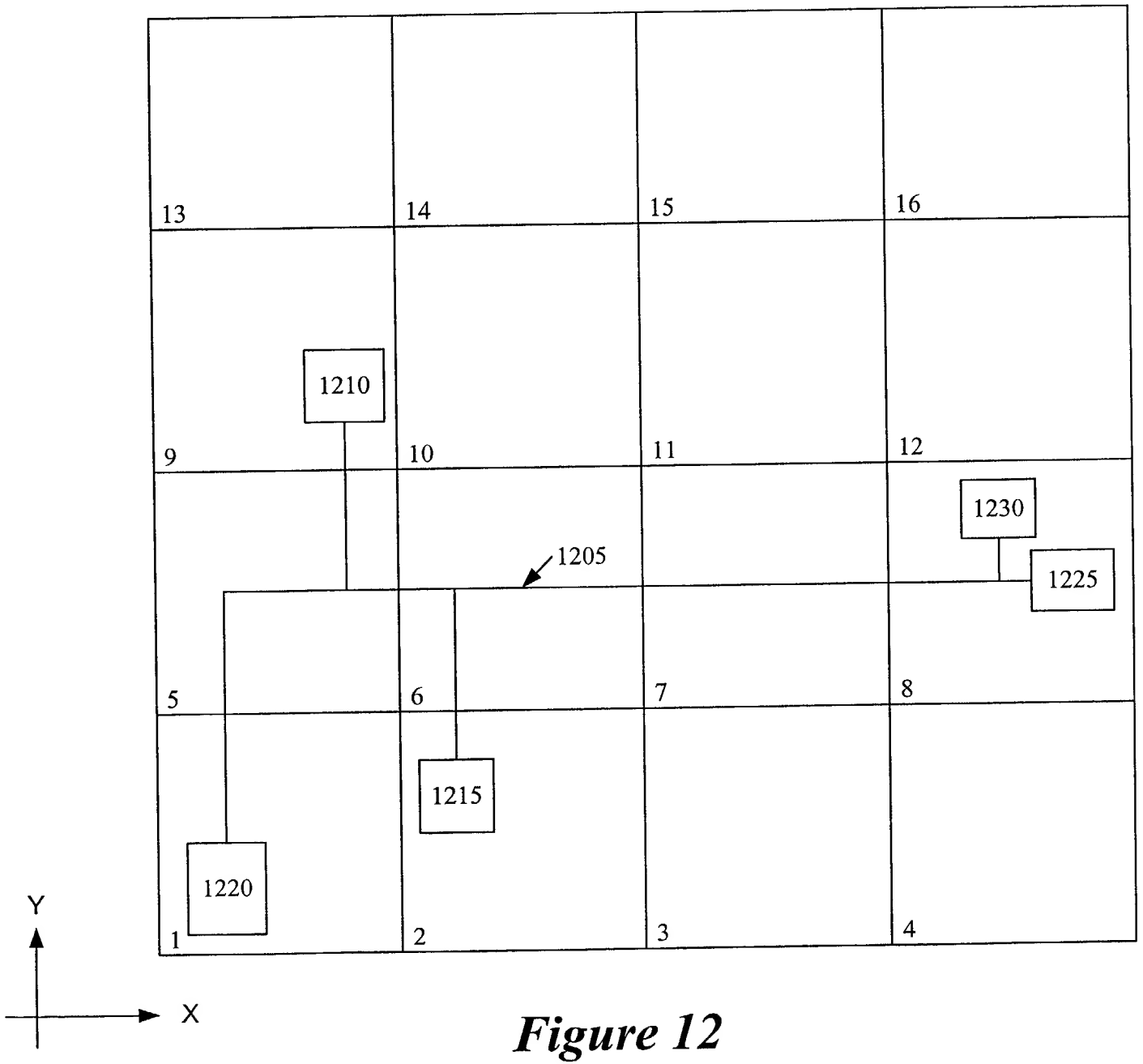

Figure 12

T06020 "6856260

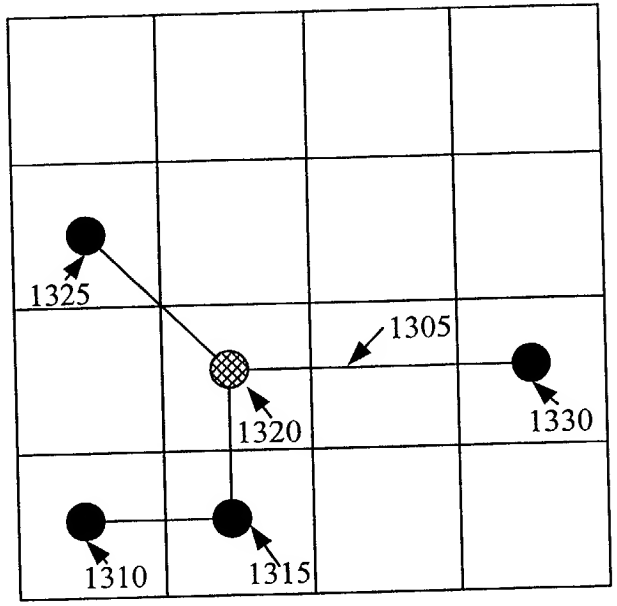

Figure 13

T06020" 6856260

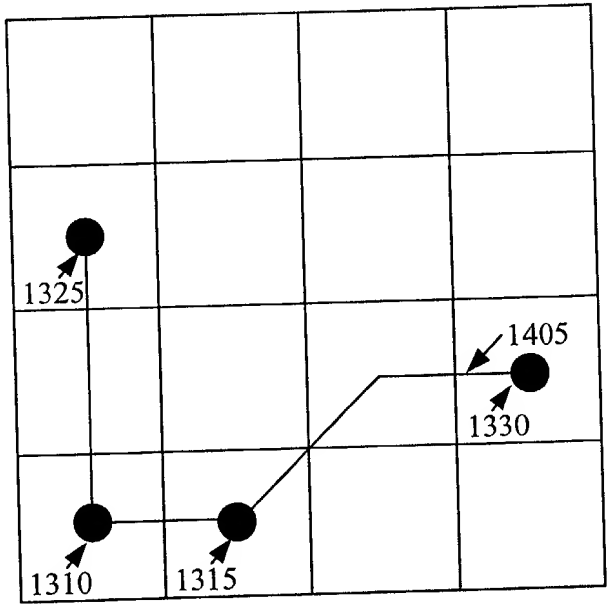

Figure 14

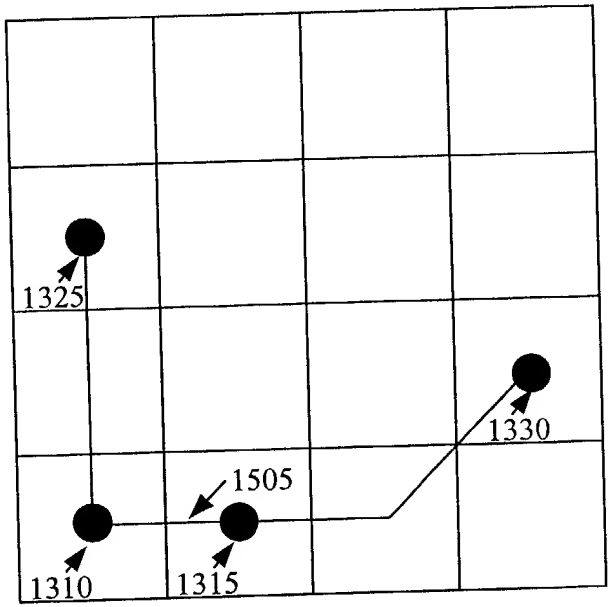

Figure 15

TO60Z0" 6856E260

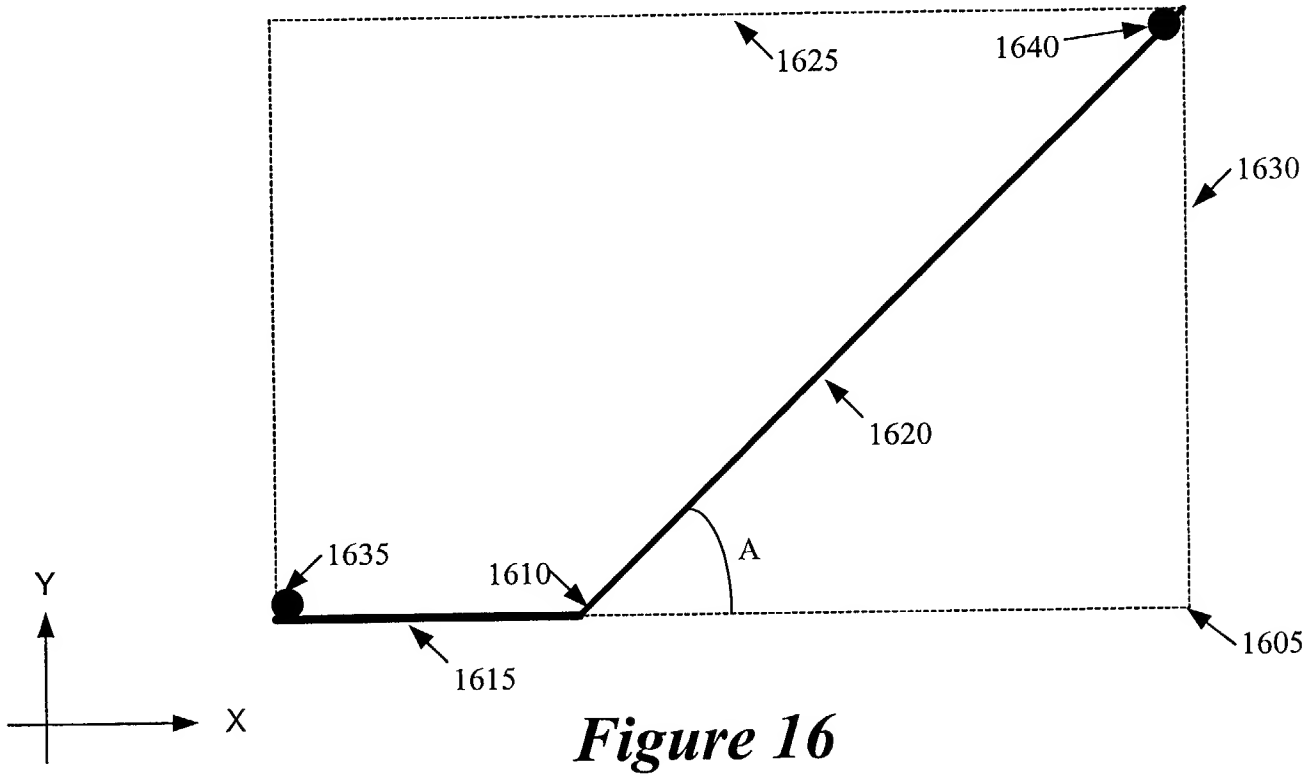

Figure 16

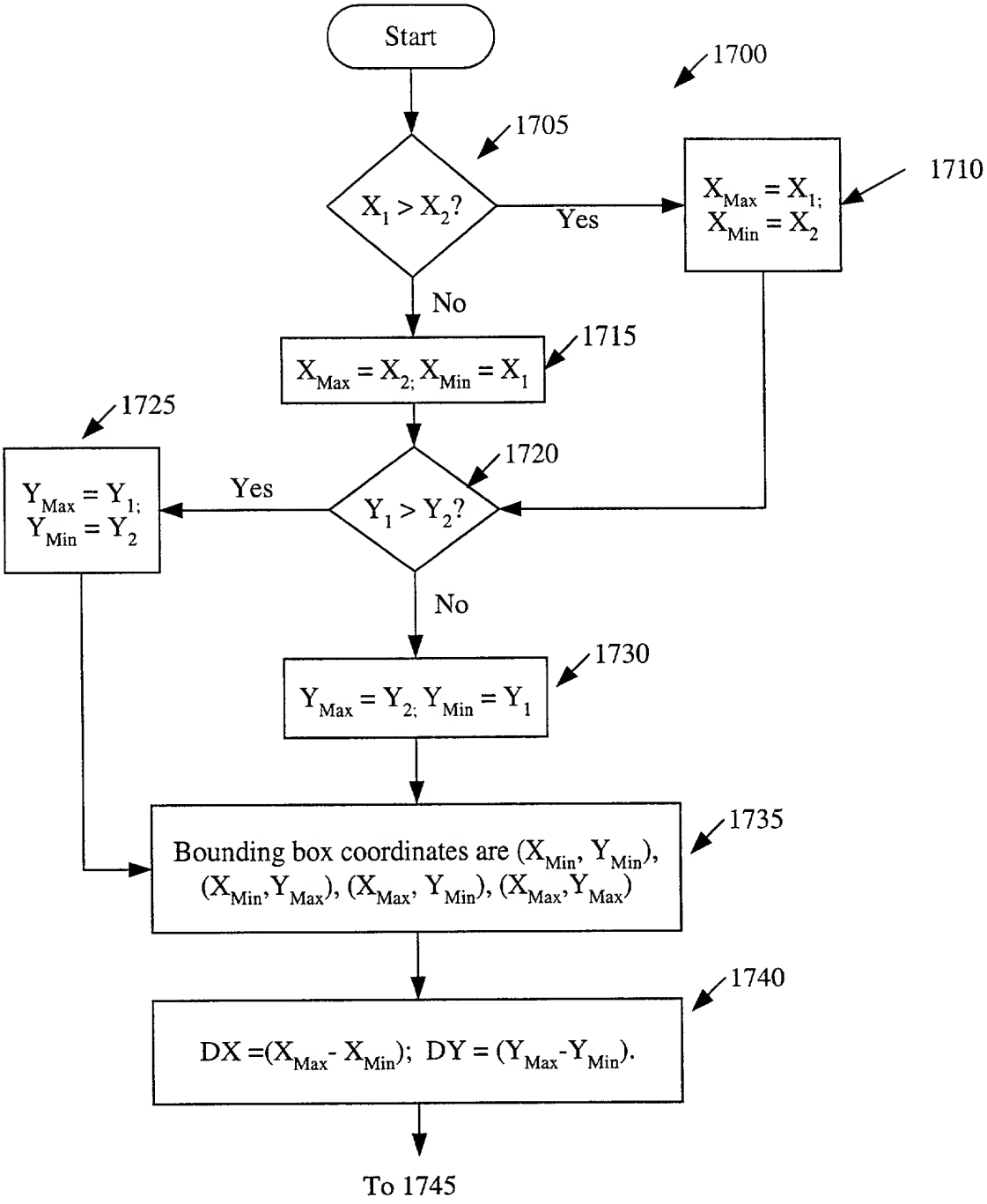

Figure 17A

Figure 17: ***Figure 17A*** / ***Figure 17B***

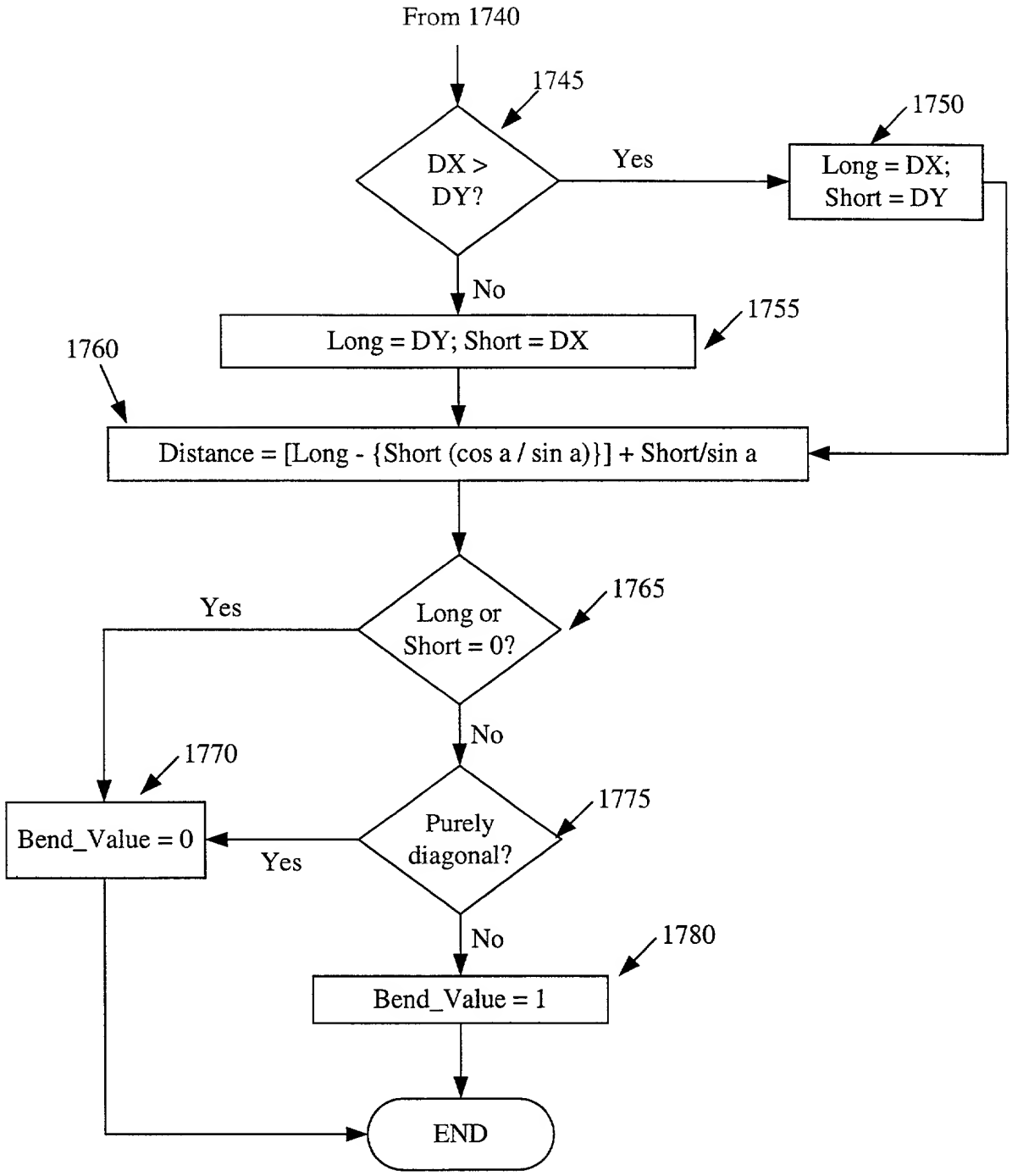
From 1740
1745
DX > DY?
Yes
1750
Long = DX; Short = DY
No
1755
Long = DY; Short = DX
1760
Distance = [Long - {Short (cos a / sin a)}] + Short/sin a
Yes
Long or Short = 0?
1765
No
1770
Bend_Value = 0
Yes
Purely diagonal?
1775
No
1780
Bend_Value = 1
END

Figure 17B

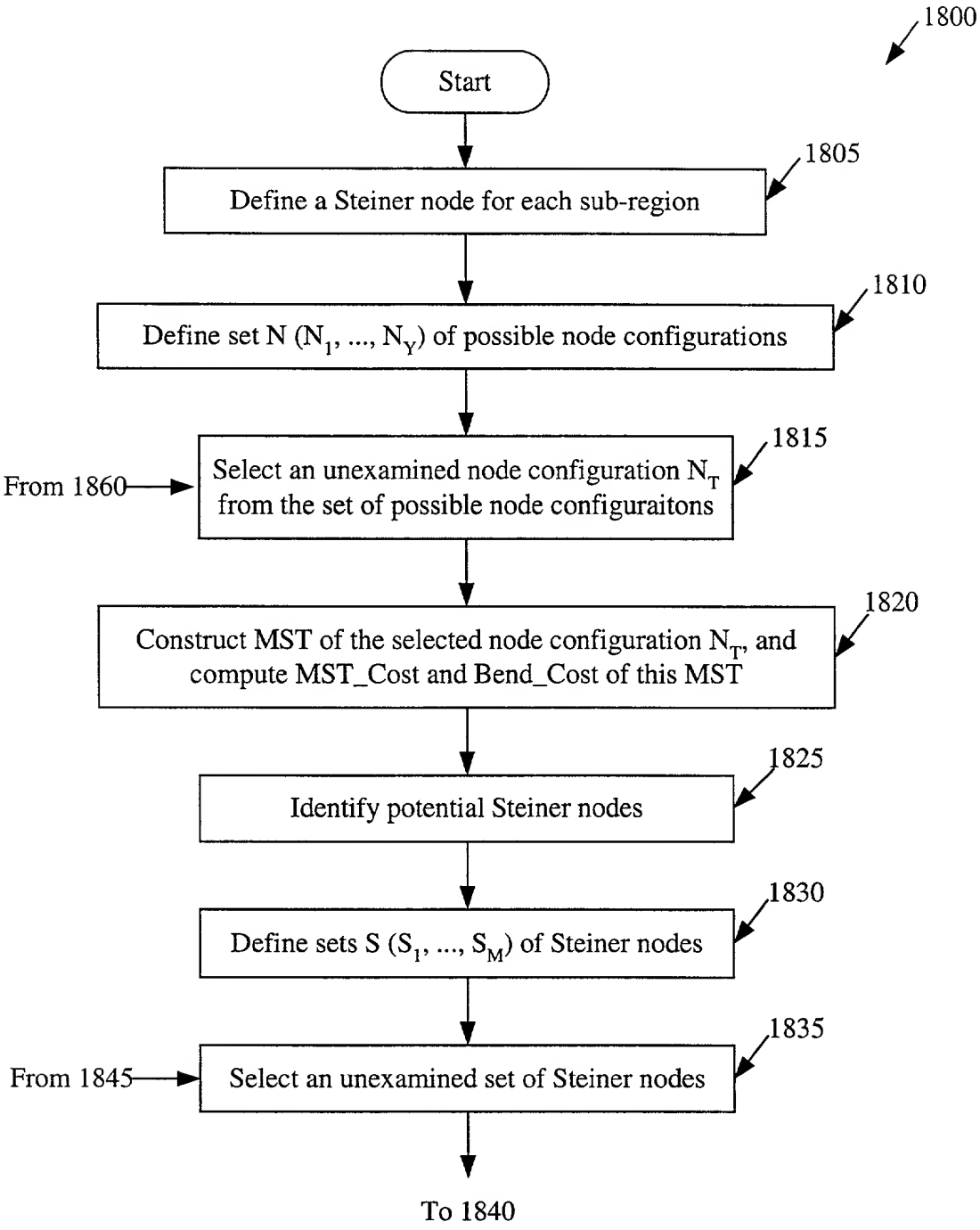

Figure 18A

Figure 18: ***Figure 18A*** / ***Figure 18B***

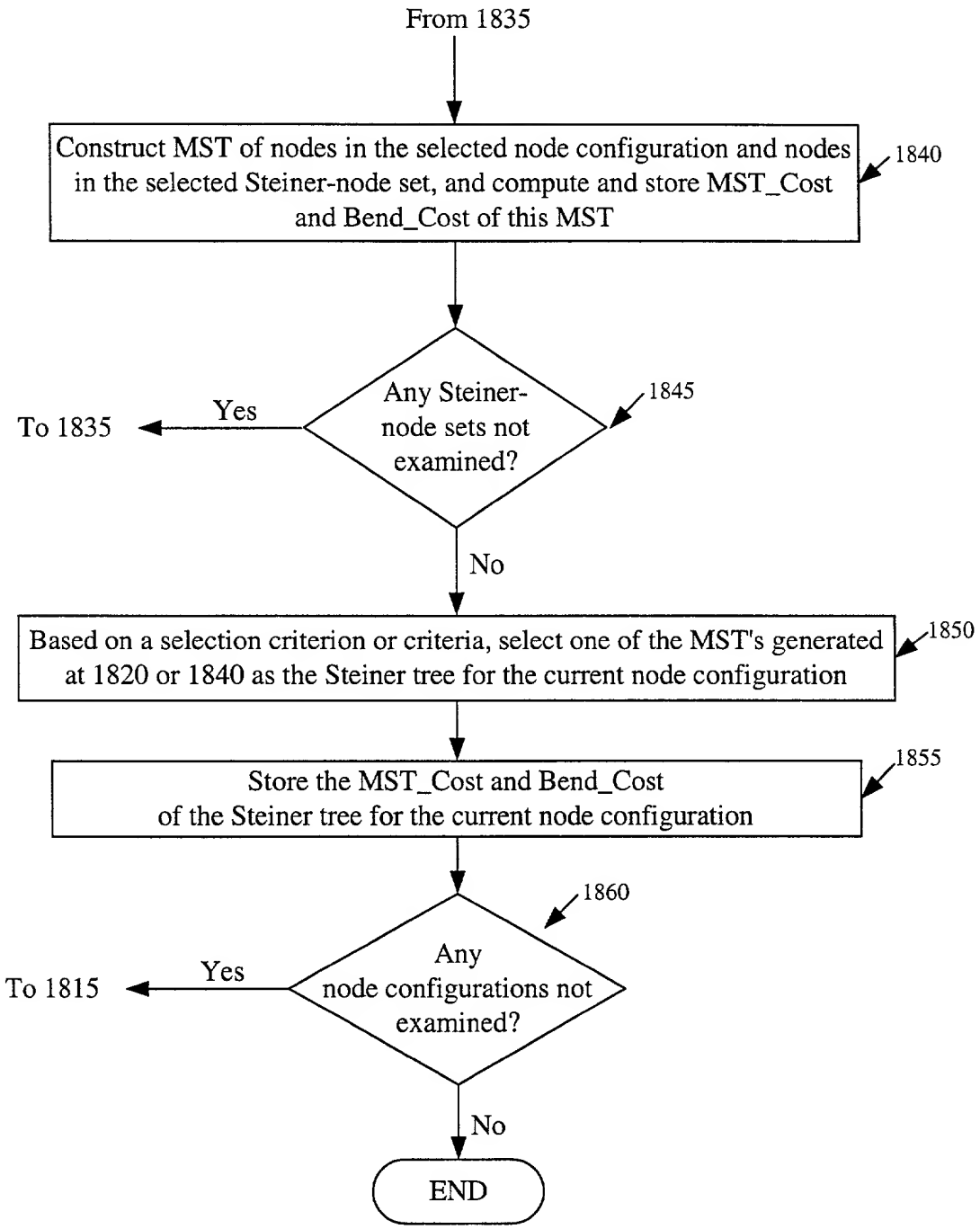
From 1835
Construct MST of nodes in the selected node configuration and nodes in the selected Steiner-node set, and compute and store MST_Cost and Bend_Cost of this MST
1840
Any Steiner-node sets not examined?
1845
Yes
To 1835
No
Based on a selection criterion or criteria, select one of the MST's generated at 1820 or 1840 as the Steiner tree for the current node configuration
1850
Store the MST_Cost and Bend_Cost of the Steiner tree for the current node configuration
1855
Any node configurations not examined?
1860
Yes
To 1815
No
END

Figure 18B

T06020 "68568260

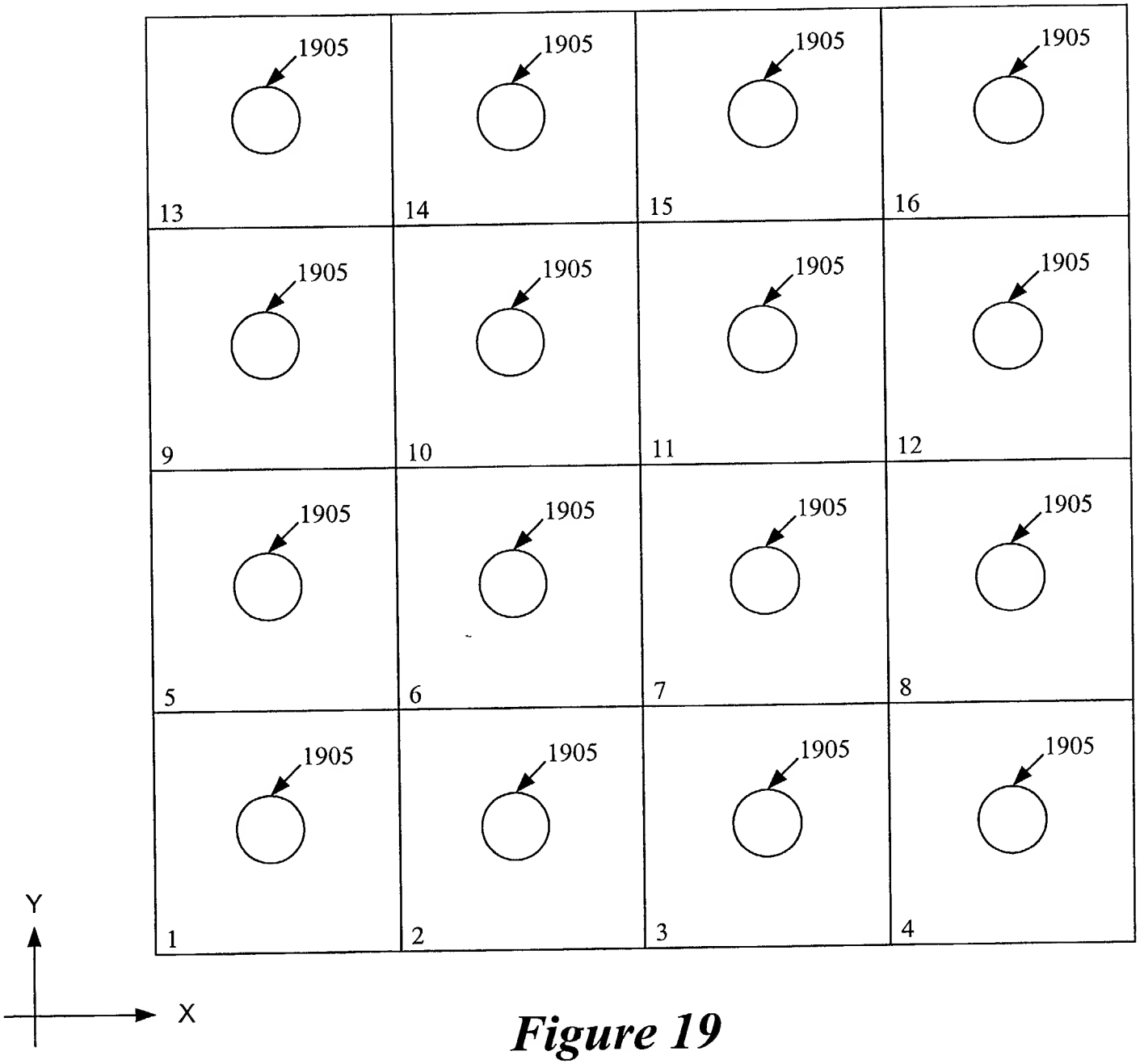

Figure 19

T06020 "68568260

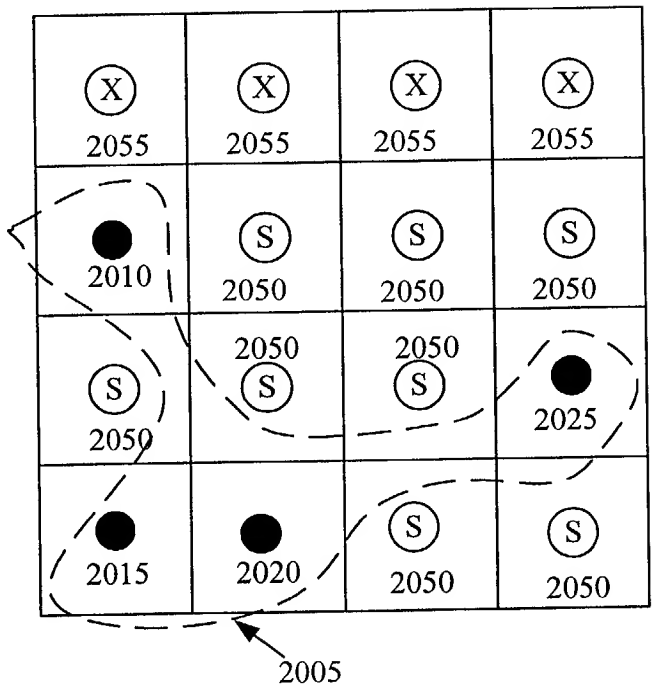

Figure 20

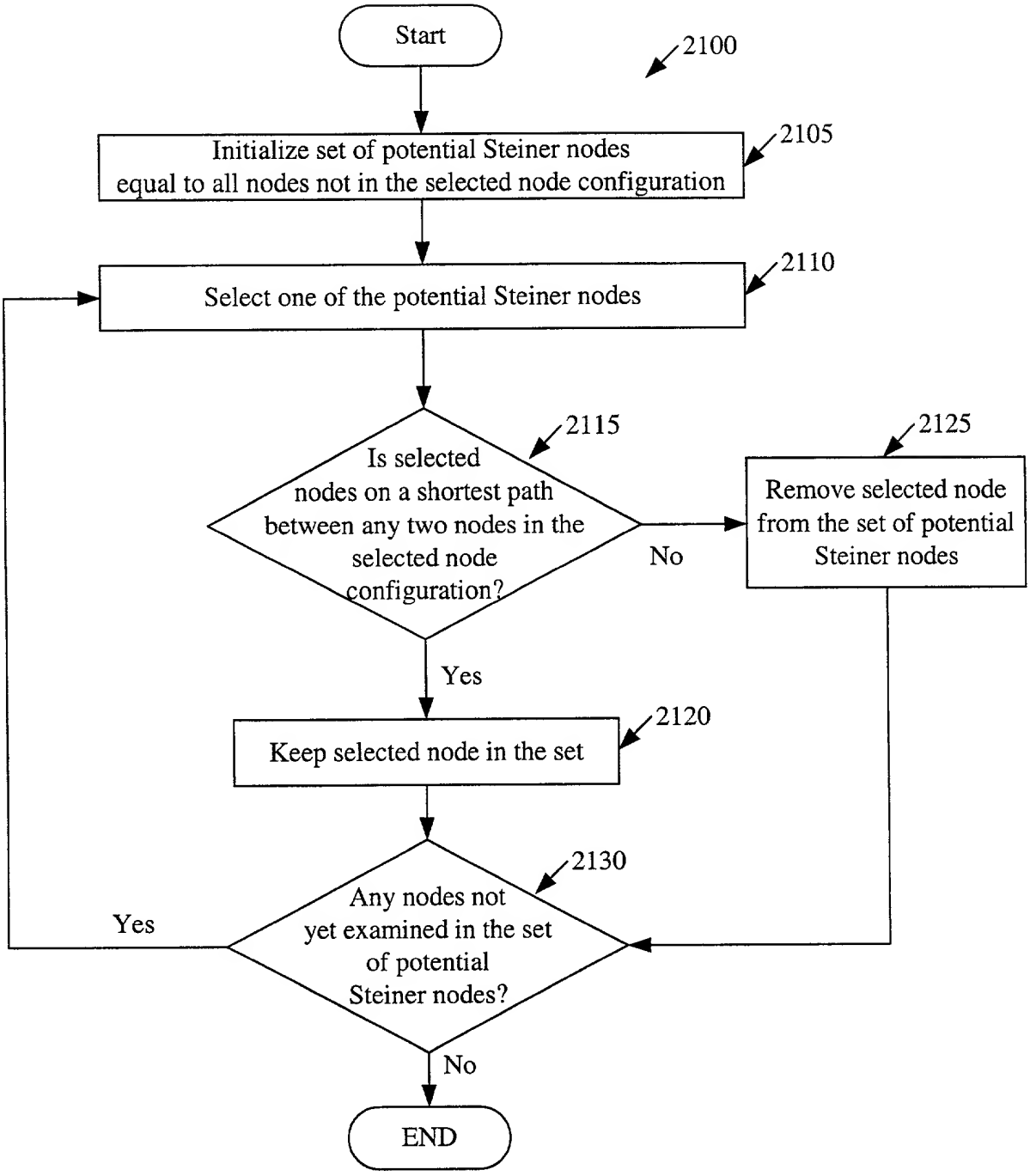
Start
2100
Initialize set of potential Steiner nodes equal to all nodes not in the selected node configuration
2105
Select one of the potential Steiner nodes
2110
Is selected nodes on a shortest path between any two nodes in the selected node configuration?
2115
No
Remove selected node from the set of potential Steiner nodes
2125
Yes
Keep selected node in the set
2120
Any nodes not yet examined in the set of potential Steiner nodes?
2130
Yes
No
END

Figure 21

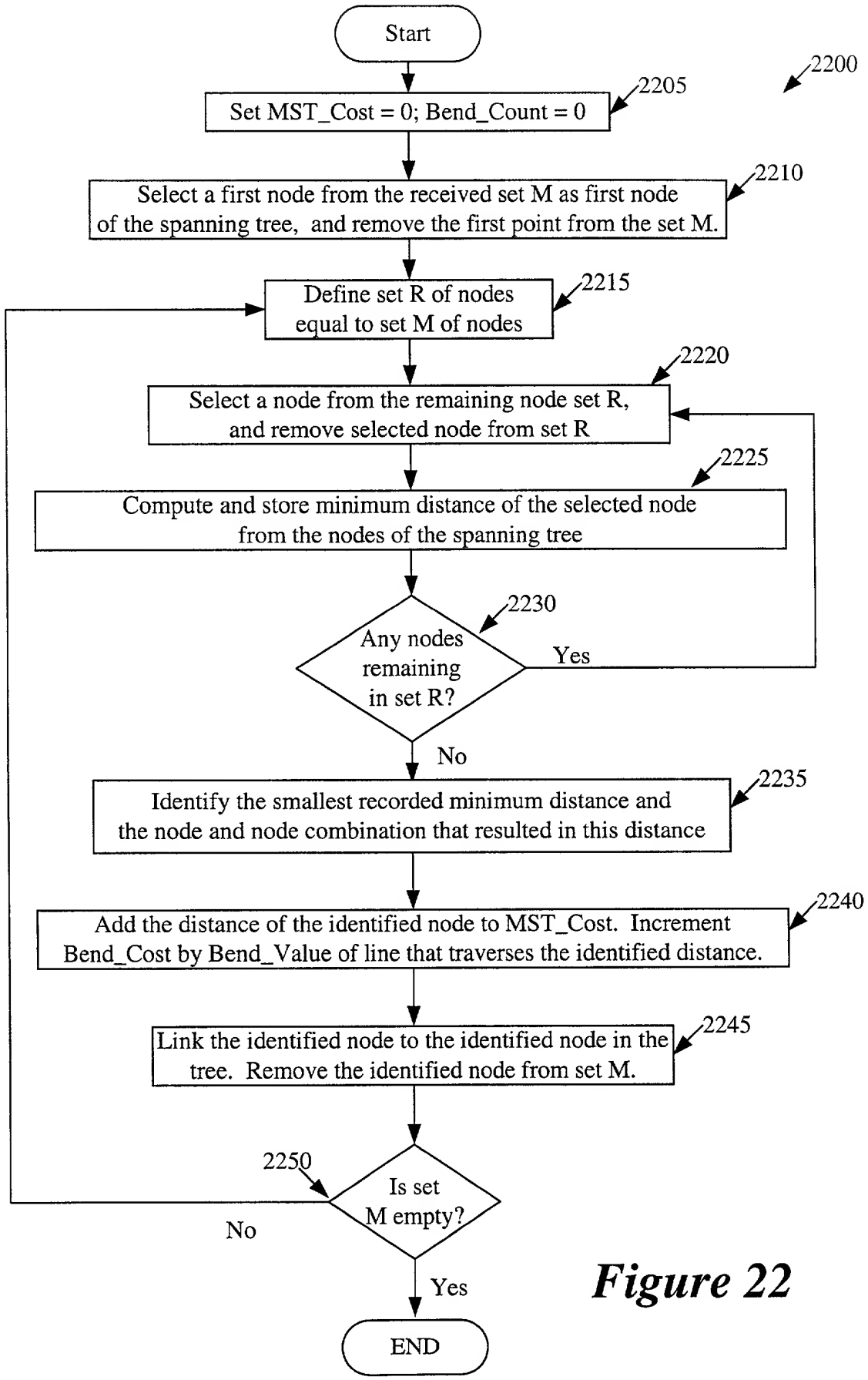
Start
2200
2205
Set MST_Cost = 0; Bend_Count = 0
2210
Select a first node from the received set M as first node of the spanning tree, and remove the first point from the set M.
2215
Define set R of nodes equal to set M of nodes
2220
Select a node from the remaining node set R, and remove selected node from set R
2225
Compute and store minimum distance of the selected node from the nodes of the spanning tree
2230
Any nodes remaining in set R?
Yes
No
2235
Identify the smallest recorded minimum distance and the node and node combination that resulted in this distance
2240
Add the distance of the identified node to MST_Cost. Increment Bend_Cost by Bend_Value of line that traverses the identified distance.
2245
Link the identified node to the identified node in the tree. Remove the identified node from set M.
2250
Is set M empty?
No
Yes
END

Figure 22

T060Z0" 6856E260

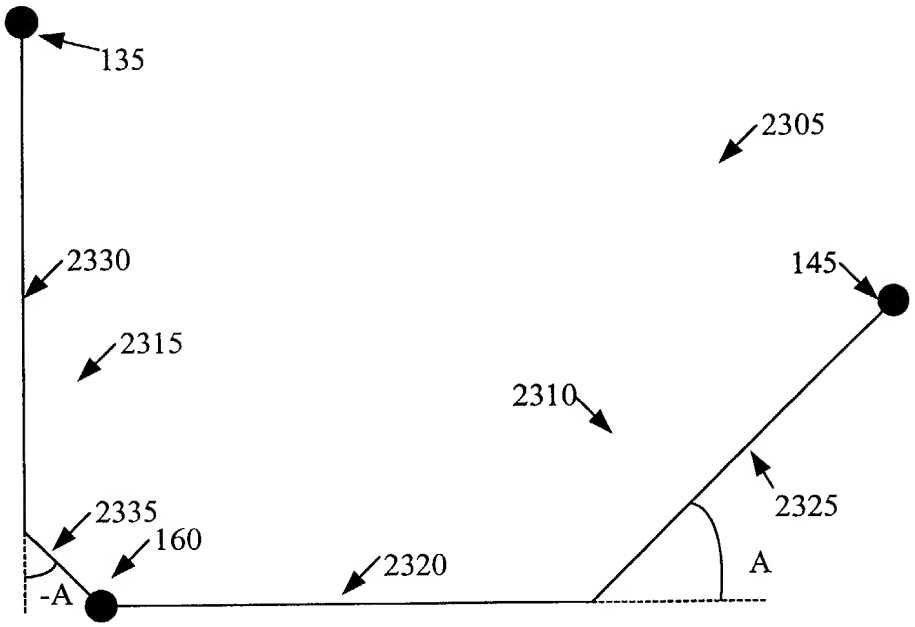

Figure 23

EP 0 660 270 A2

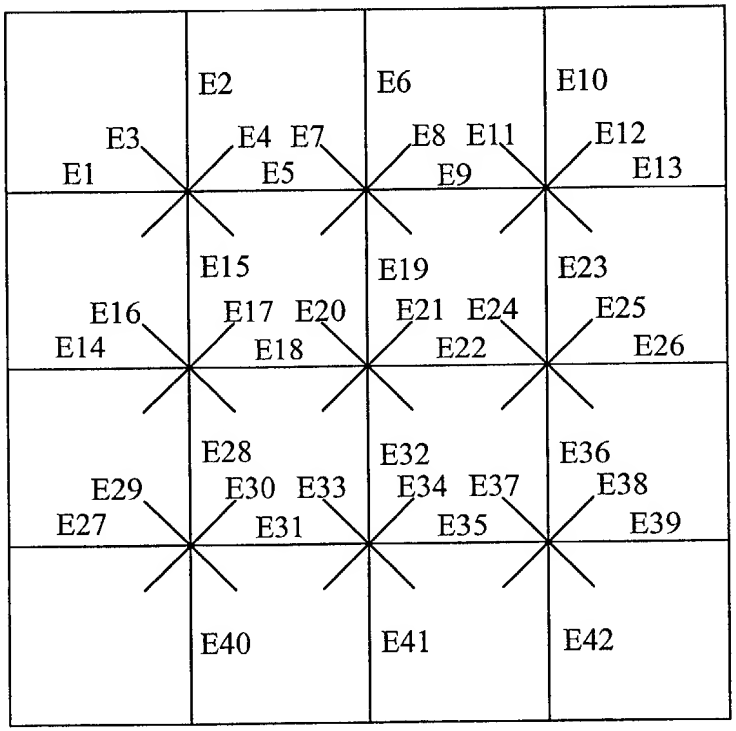

Figure 24

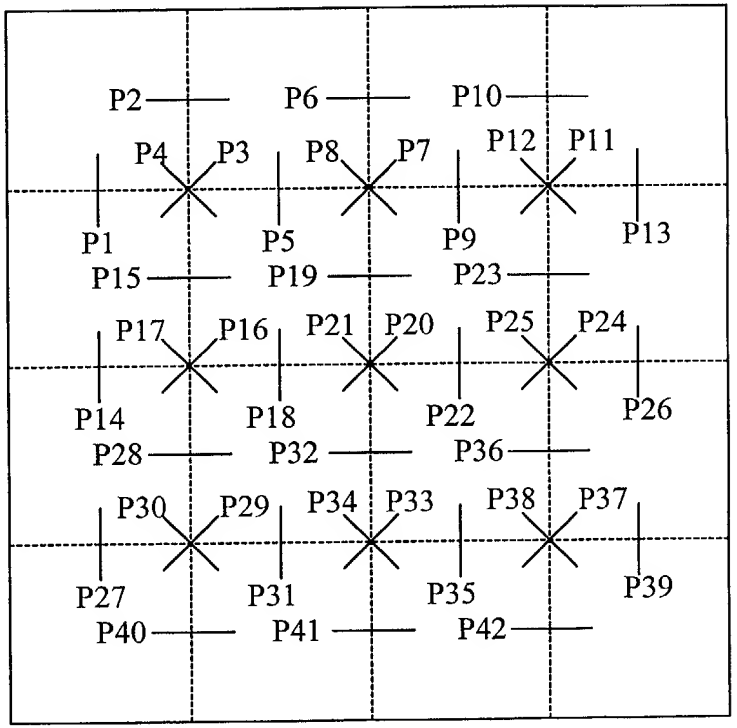

Figure 25

T0602D "6856E26D

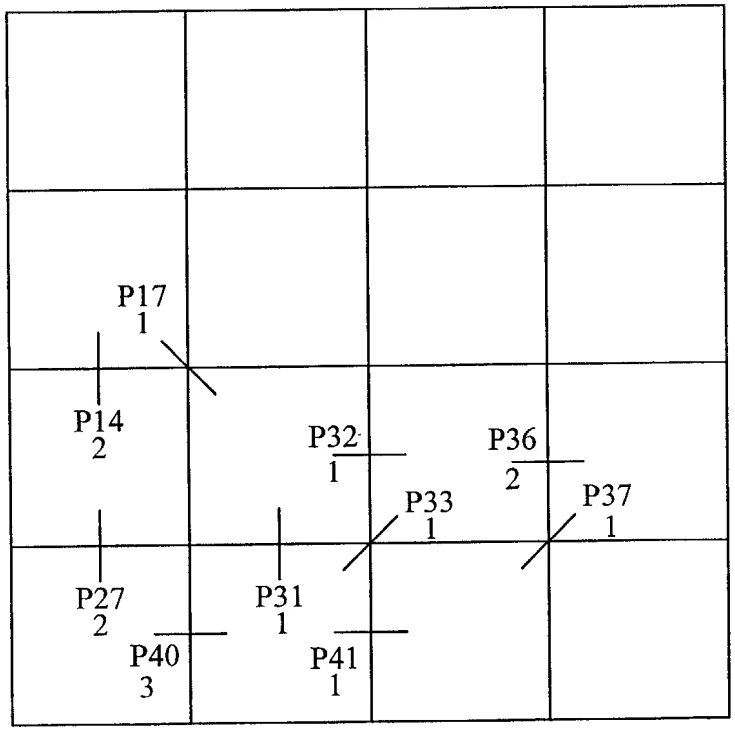

Figure 26

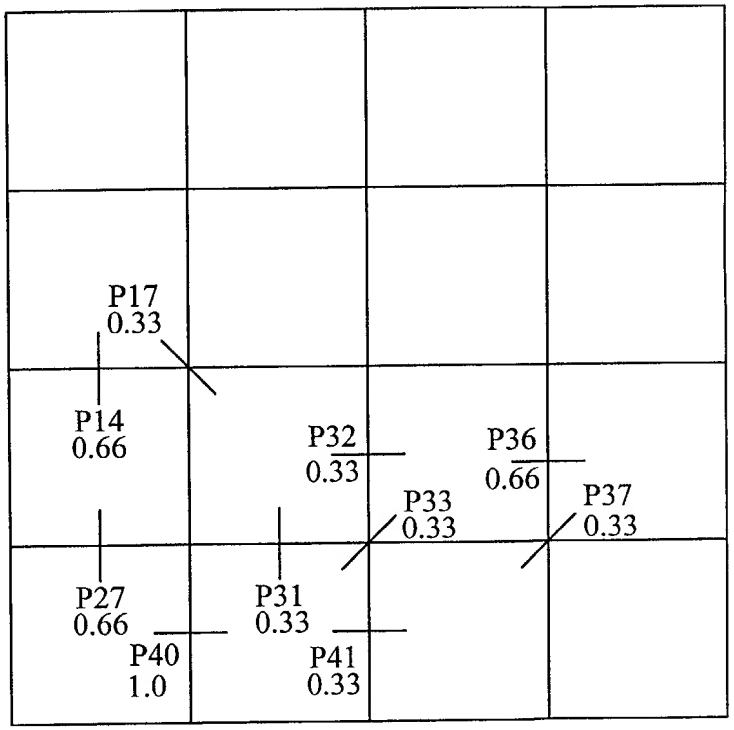

Figure 27

T0602D" 6856E260

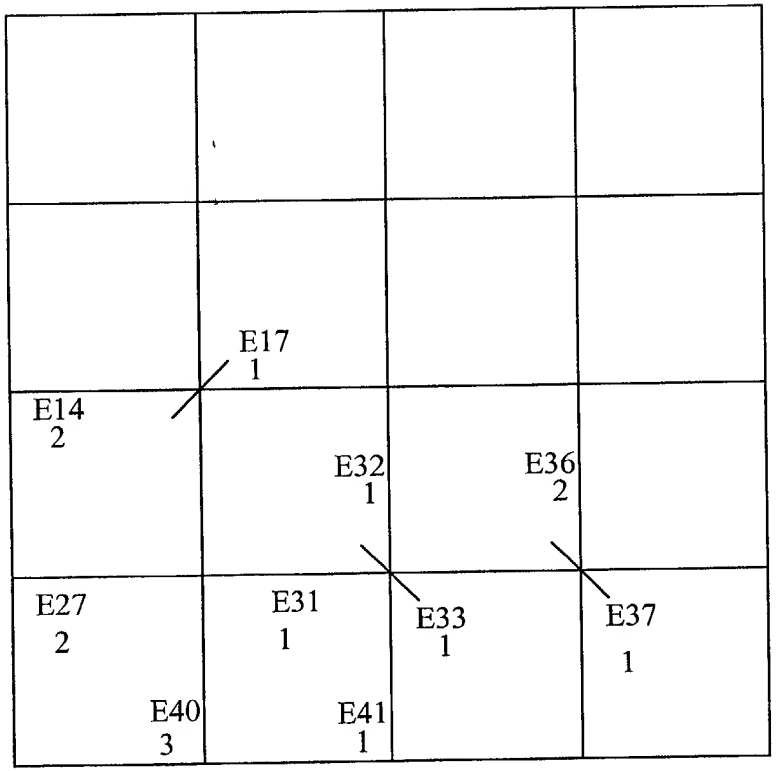

Figure 28

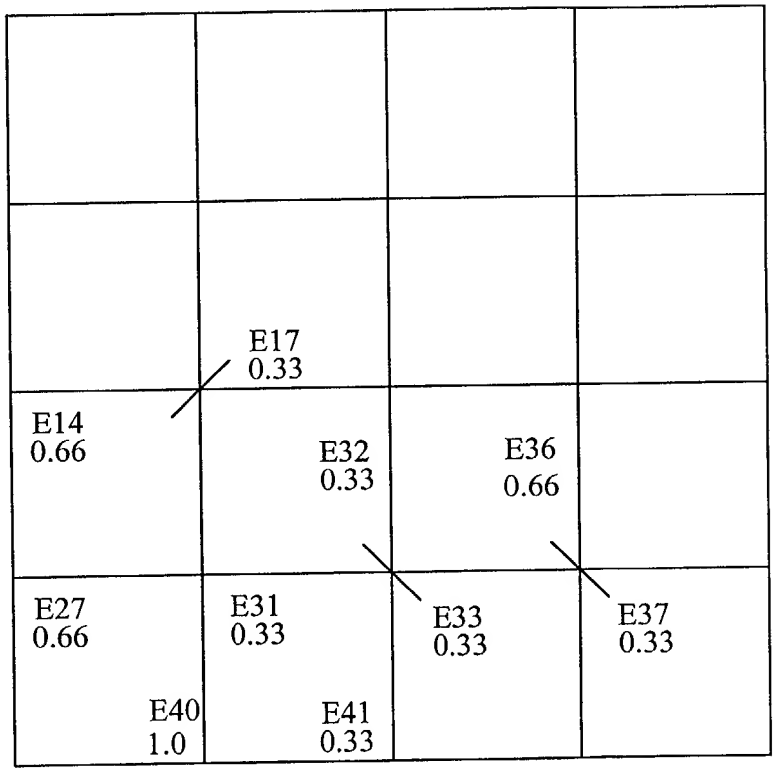

Figure 29

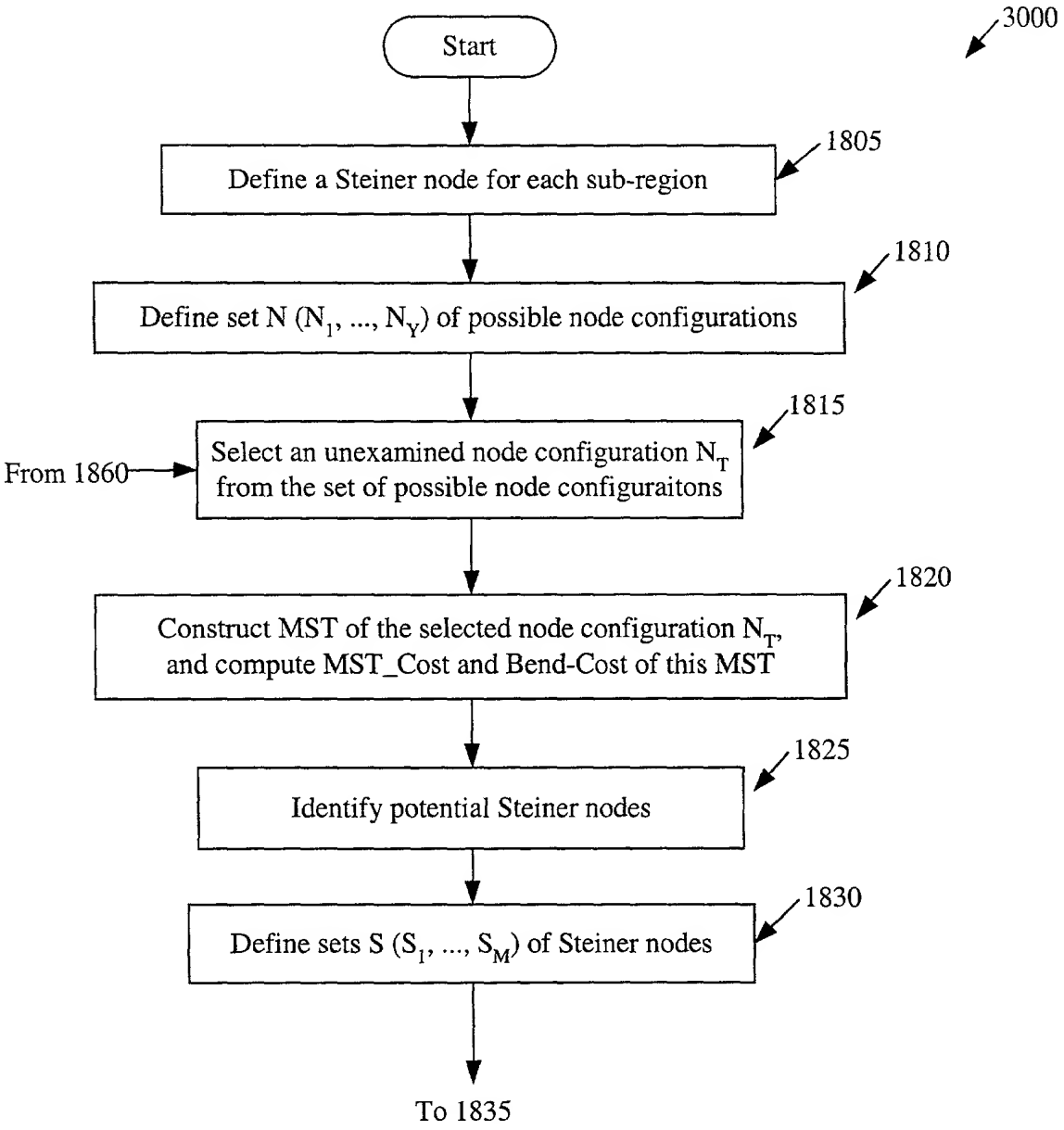

Figure 30A

Figure 30: ***Figure 30A*** / ***Figure 30B***

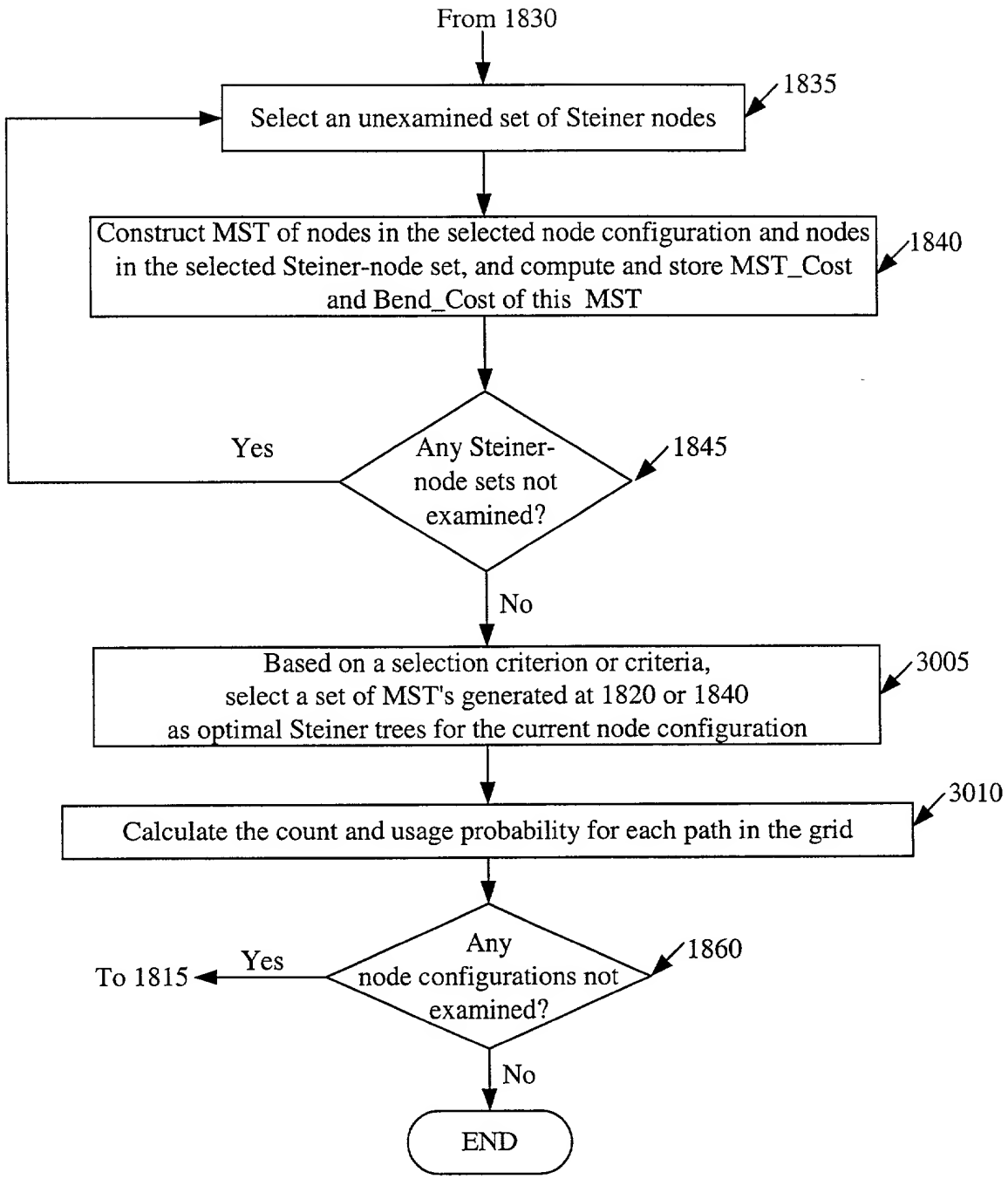
From 1830
Select an unexamined set of Steiner nodes
1835
Construct MST of nodes in the selected node configuration and nodes in the selected Steiner-node set, and compute and store MST_Cost and Bend_Cost of this MST
1840
Any Steiner-node sets not examined?
1845
Yes
No
Based on a selection criterion or criteria, select a set of MST's generated at 1820 or 1840 as optimal Steiner trees for the current node configuration
3005
Calculate the count and usage probability for each path in the grid
3010
Any node configurations not examined?
1860
Yes
To 1815
No
END

Figure 30B

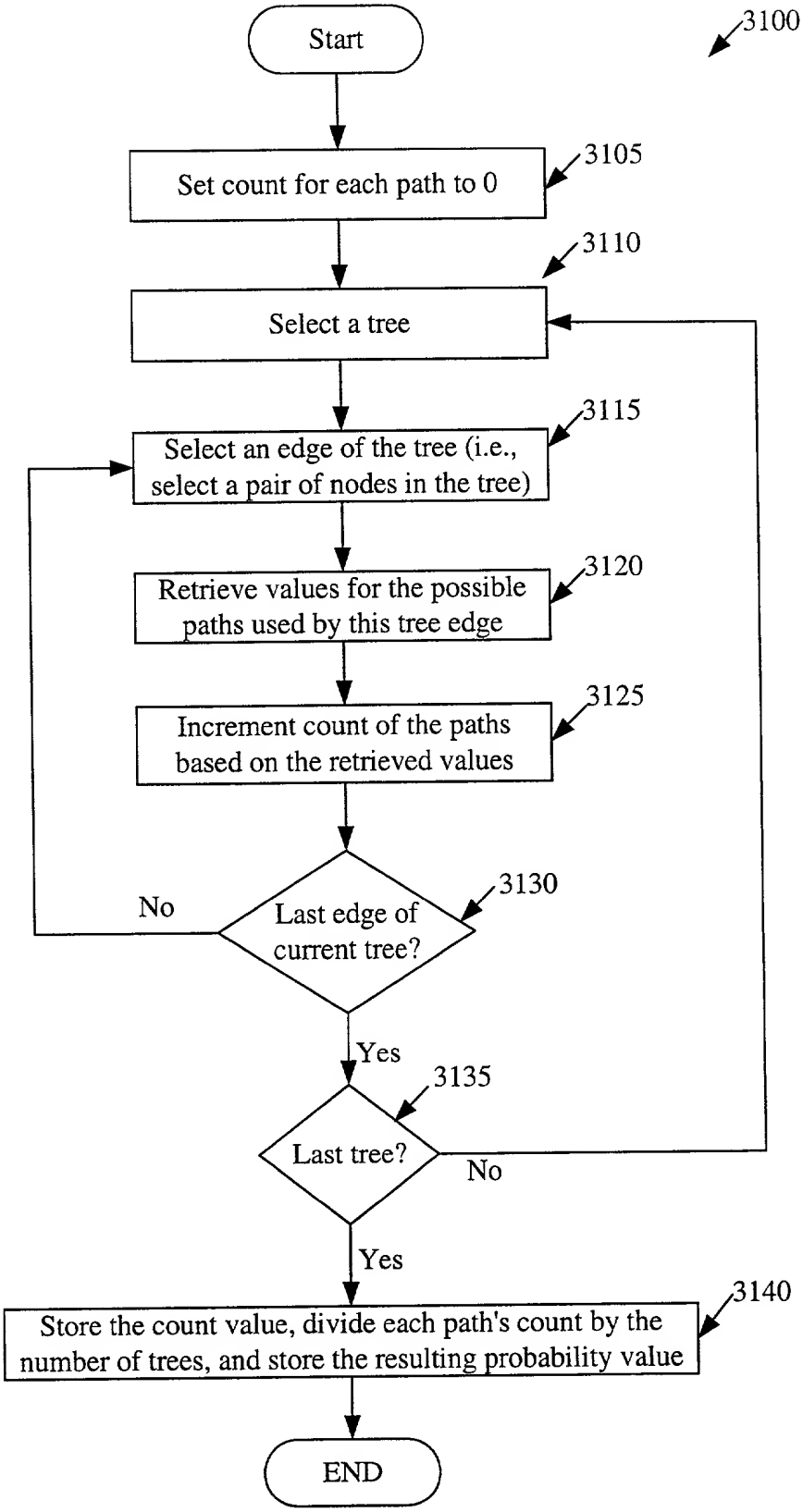
3100
Start
Set count for each path to 0
3105
3110
Select a tree
3115
Select an edge of the tree (i.e., select a pair of nodes in the tree)
3120
Retrieve values for the possible paths used by this tree edge
3125
Increment count of the paths based on the retrieved values
3130
Last edge of current tree?
No
Yes
3135
Last tree?
No
Yes
3140
Store the count value, divide each path's count by the number of trees, and store the resulting probability value
END

Figure 31

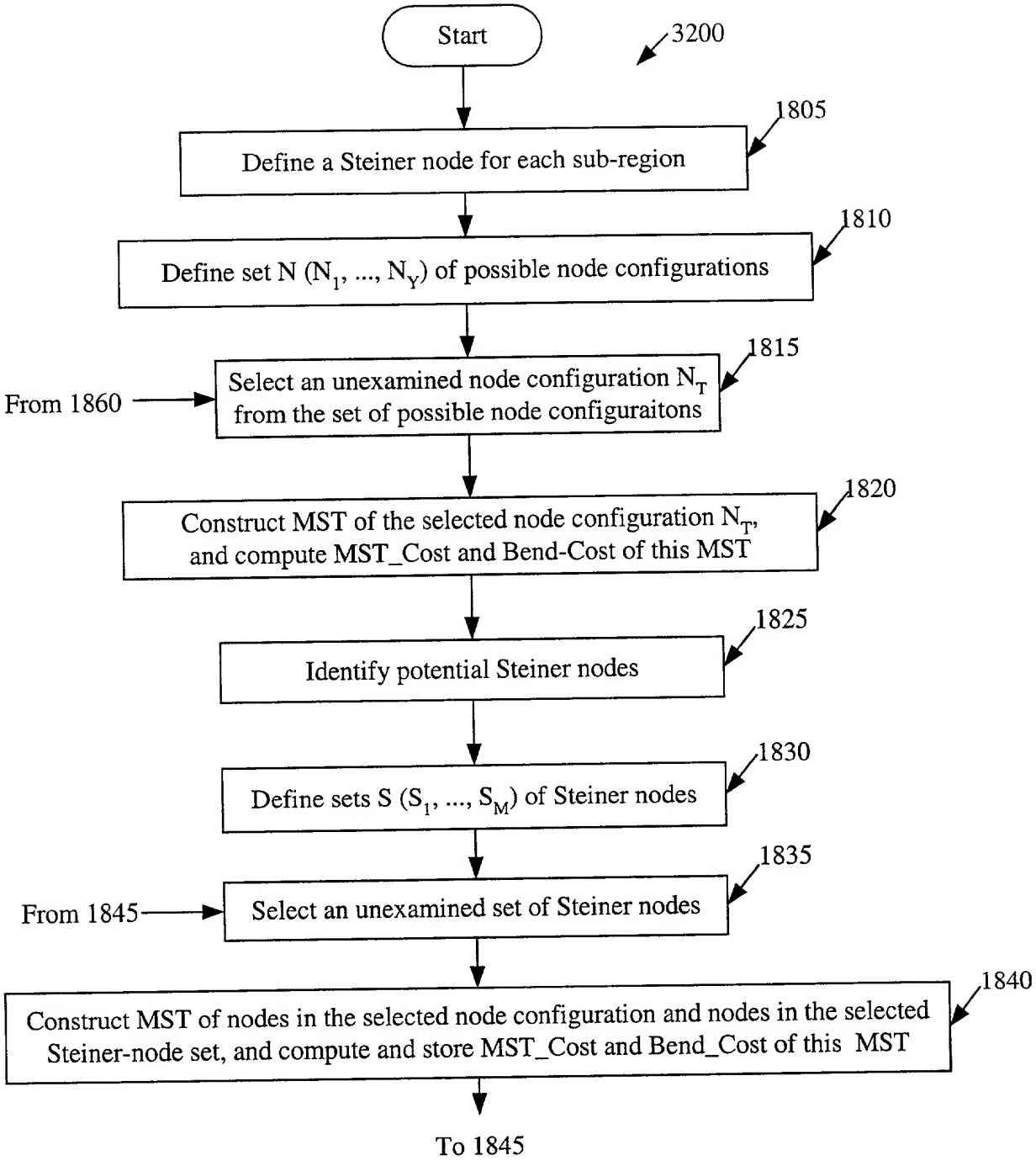

Figure 32A

Figure 32: ***Figure 32A*** / ***Figure 32B***

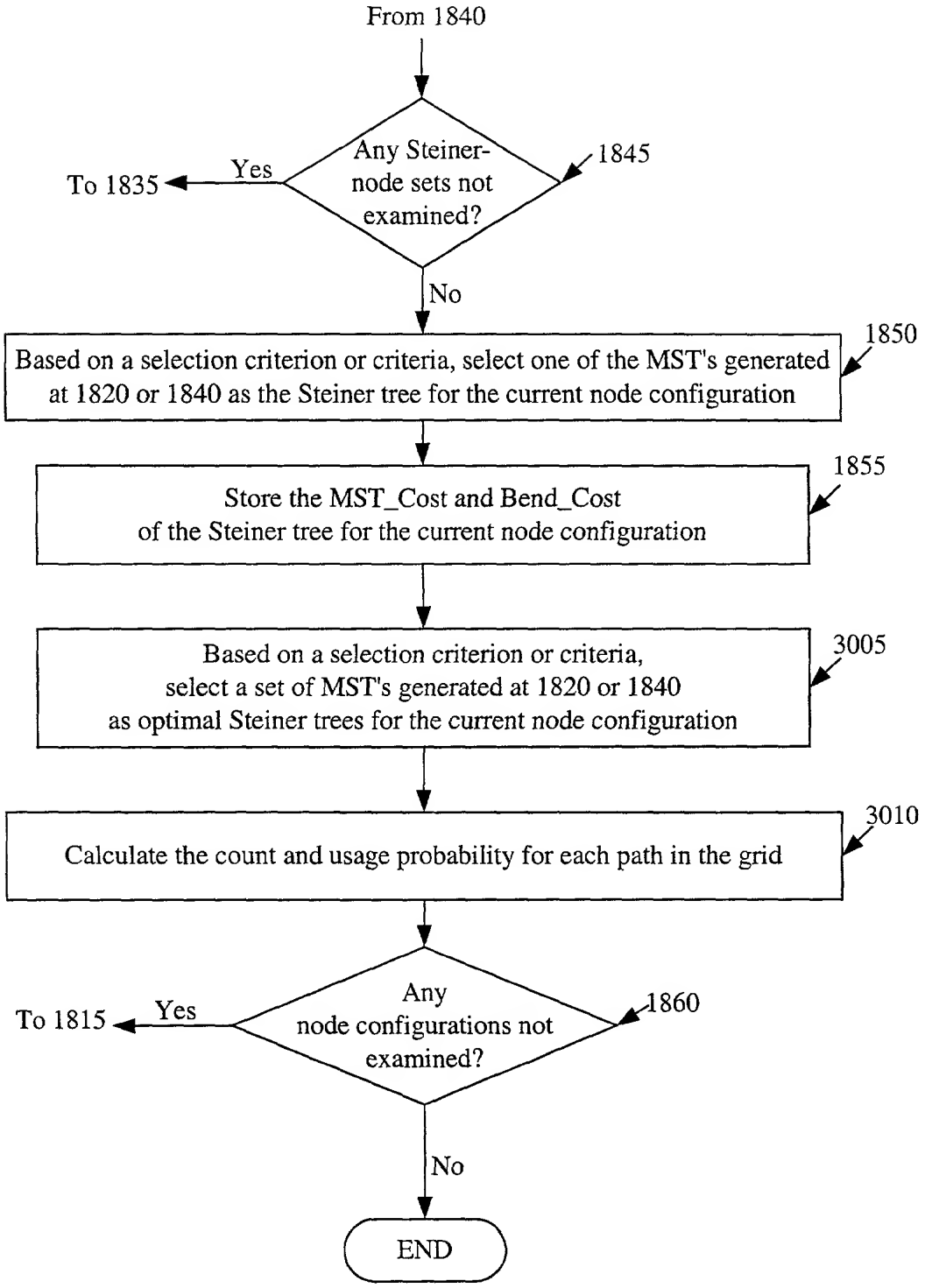
From 1840
Any Steiner-node sets not examined?
1845
Yes
To 1835
No
Based on a selection criterion or criteria, select one of the MST's generated at 1820 or 1840 as the Steiner tree for the current node configuration
1850
Store the MST_Cost and Bend_Cost of the Steiner tree for the current node configuration
1855
Based on a selection criterion or criteria, select a set of MST's generated at 1820 or 1840 as optimal Steiner trees for the current node configuration
3005
Calculate the count and usage probability for each path in the grid
3010
Any node configurations not examined?
1860
Yes
To 1815
No
END

Figure 32B

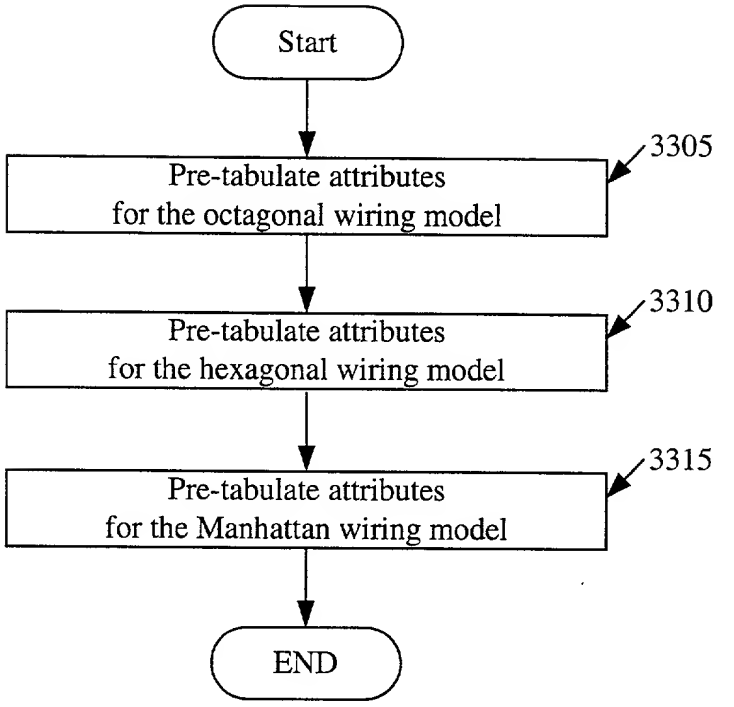
Start
3300
Pre-tabulate attributes
for the octagonal wiring model
3305
Pre-tabulate attributes
for the hexagonal wiring model
3310
Pre-tabulate attributes
for the Manhattan wiring model
3315
END

Figure 33

T0602D" 68562602

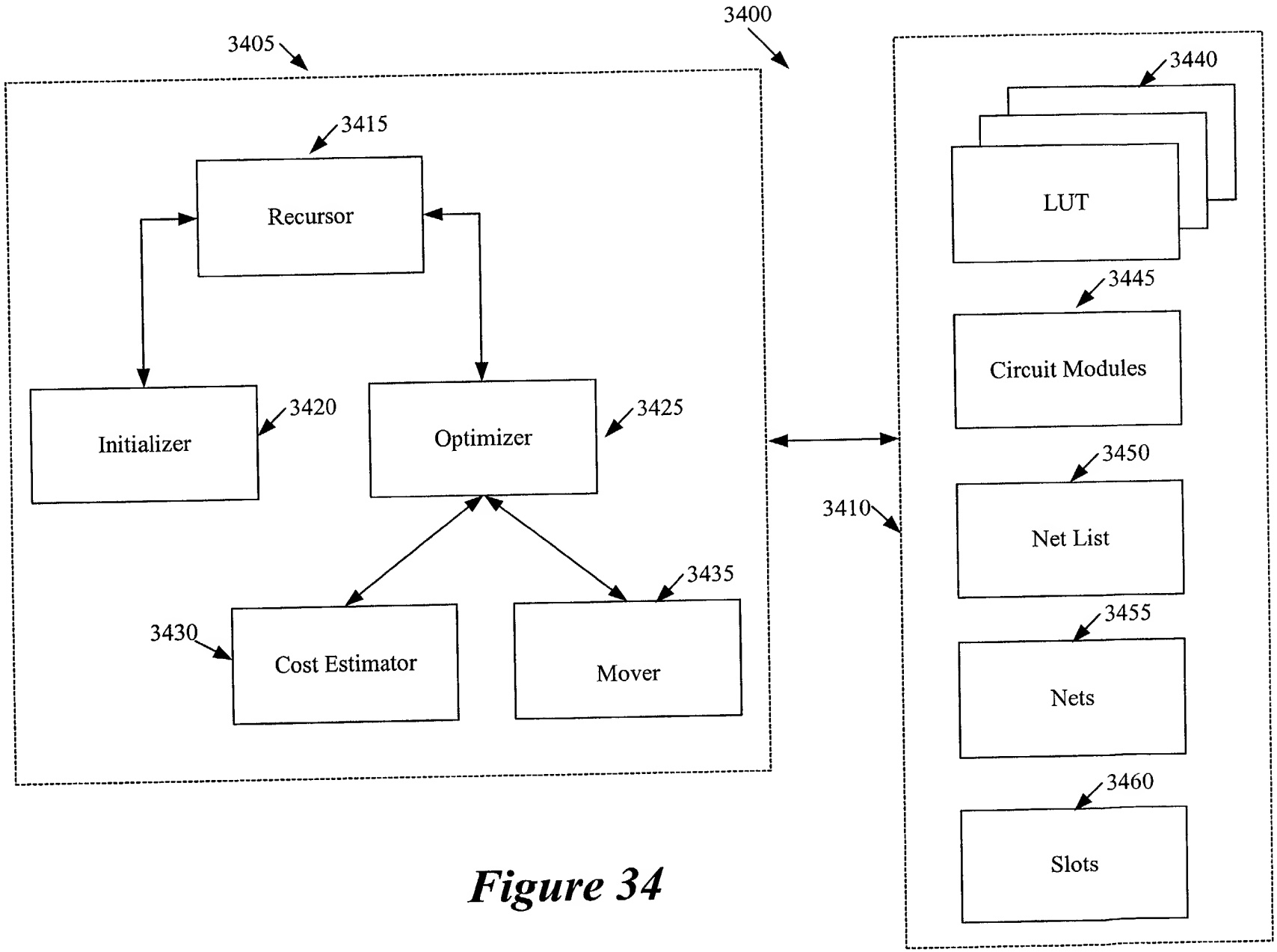

Figure 34

T06020 "6356E260

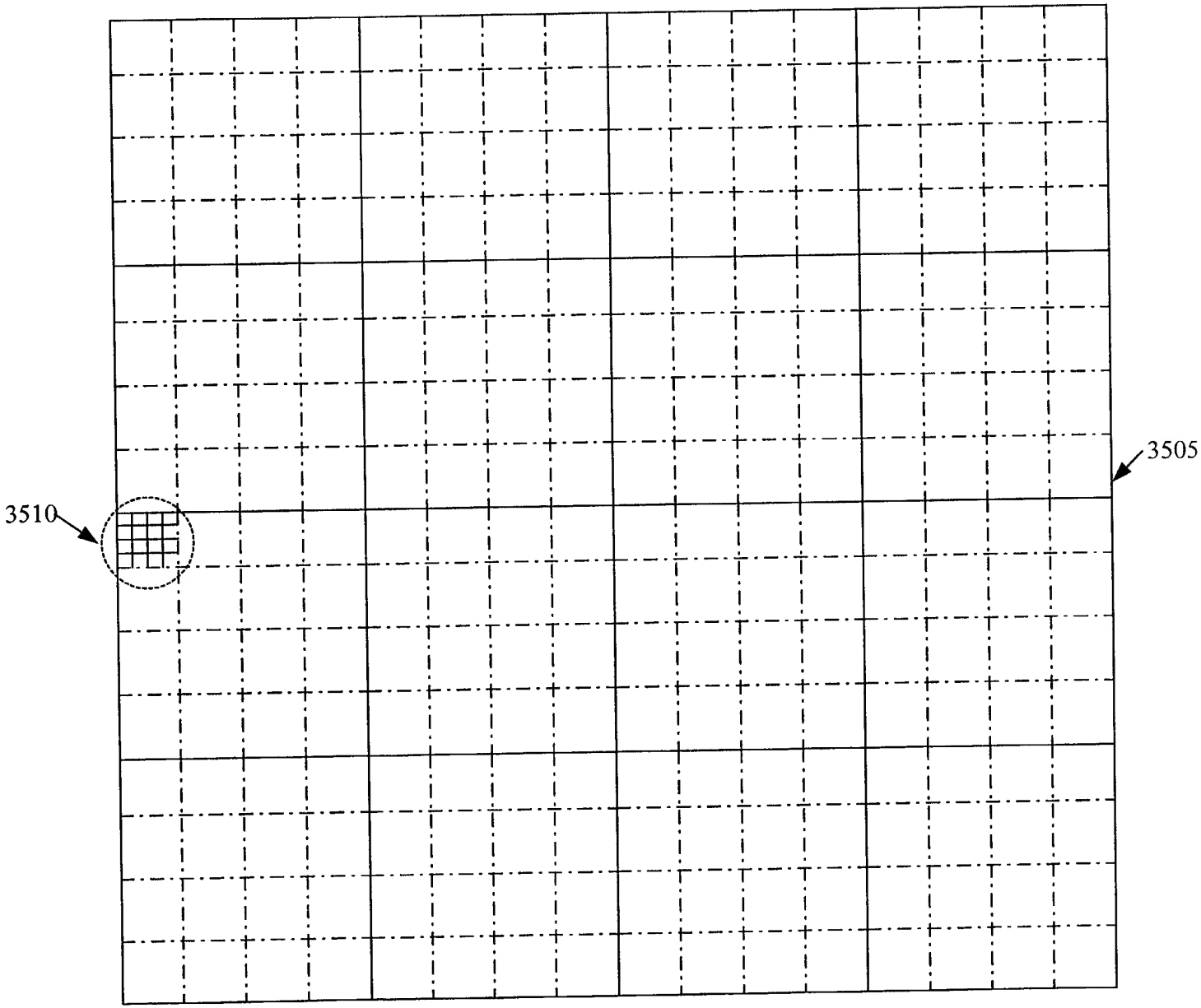

Figure 35

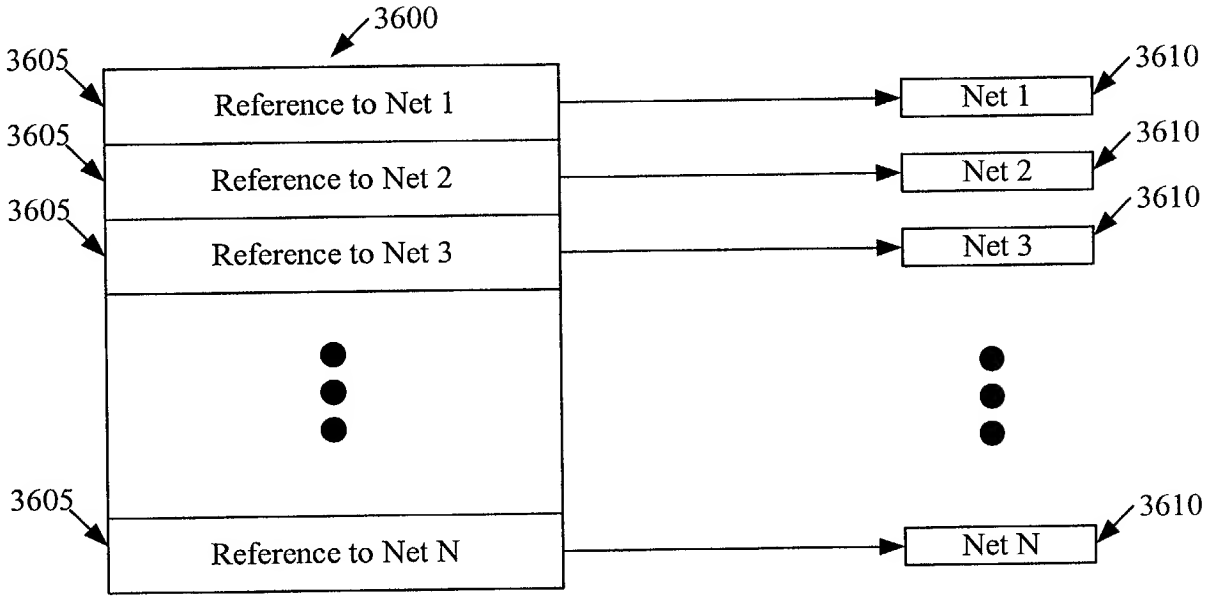
3600
3605
Reference to Net 1
3605
Reference to Net 2
3605
Reference to Net 3
3605
Reference to Net N
3610
Net 1
3610
Net 2
3610
Net 3
3610
Net N

Figure 36

T06020 "68568260

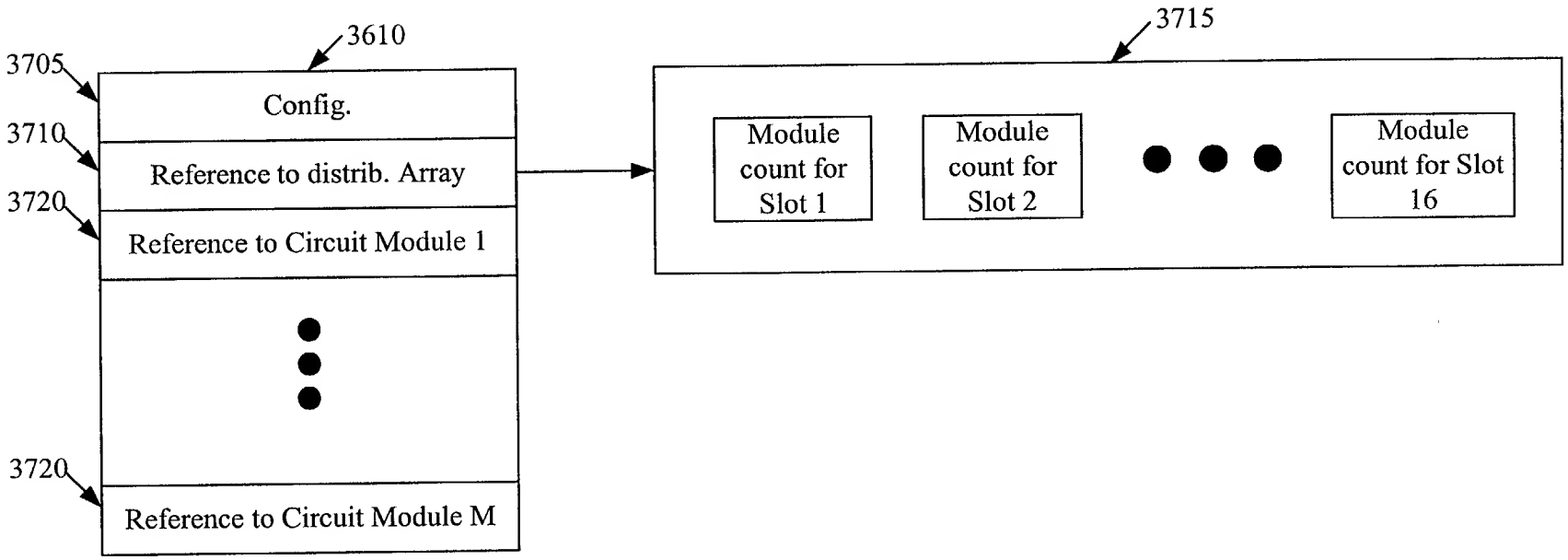

Figure 37

T0602D" 6856260

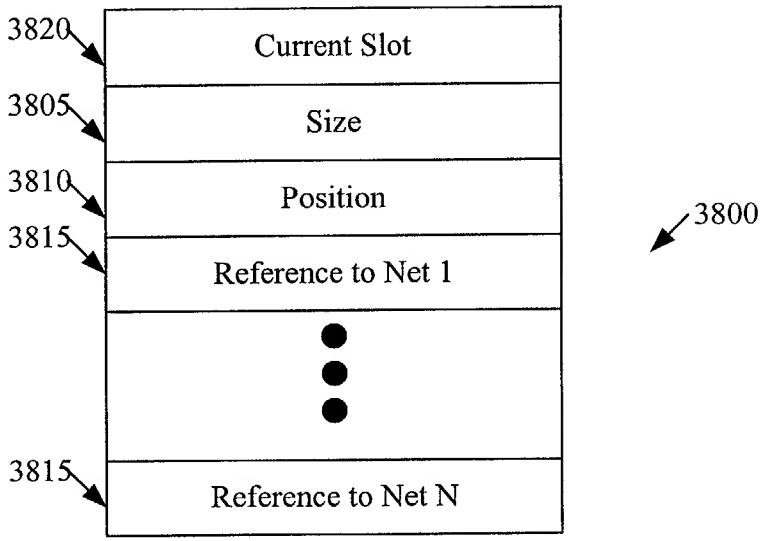

Figure 38

T0602D" 6356260

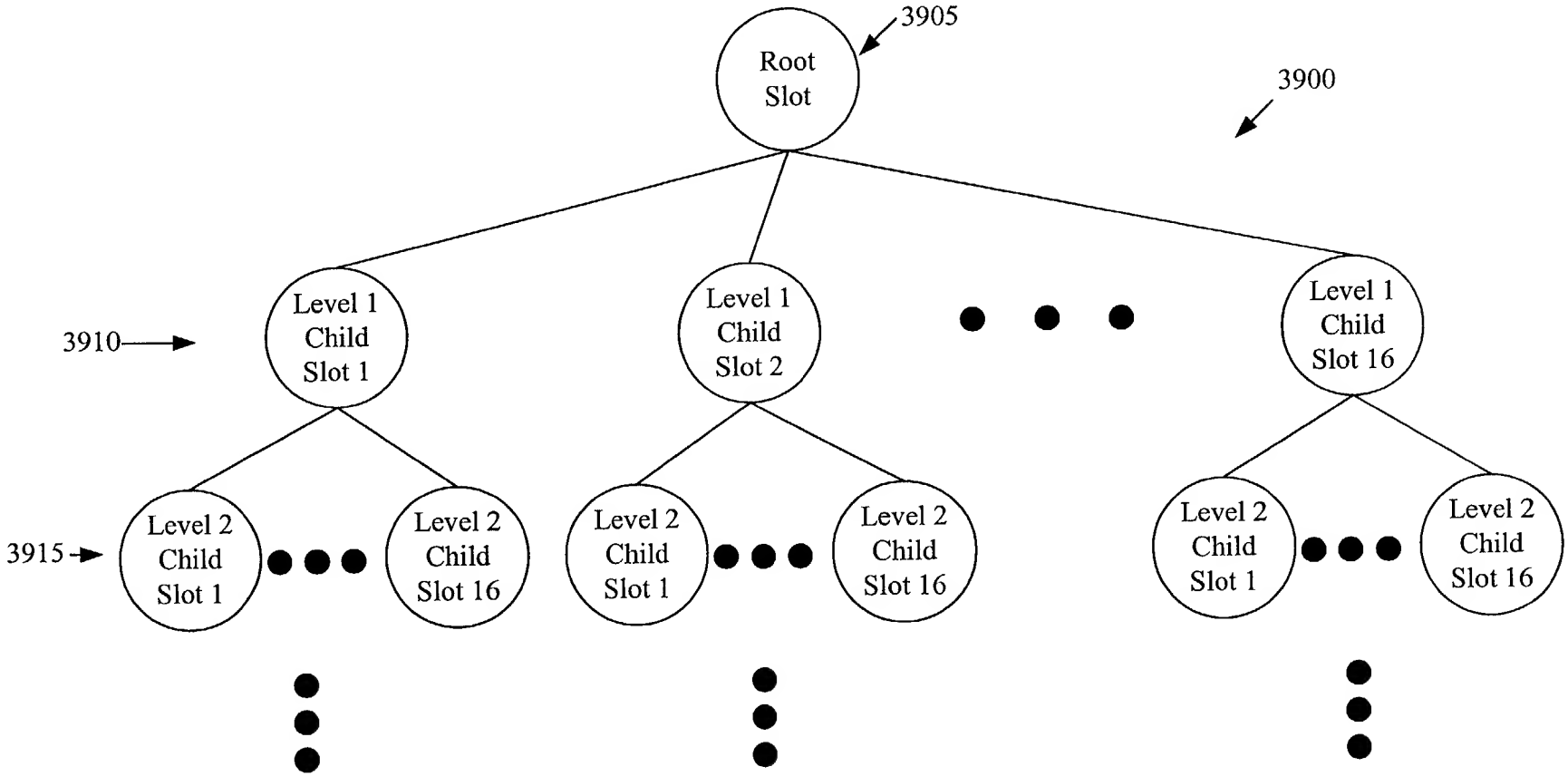

Figure 39

EP 0 685 260

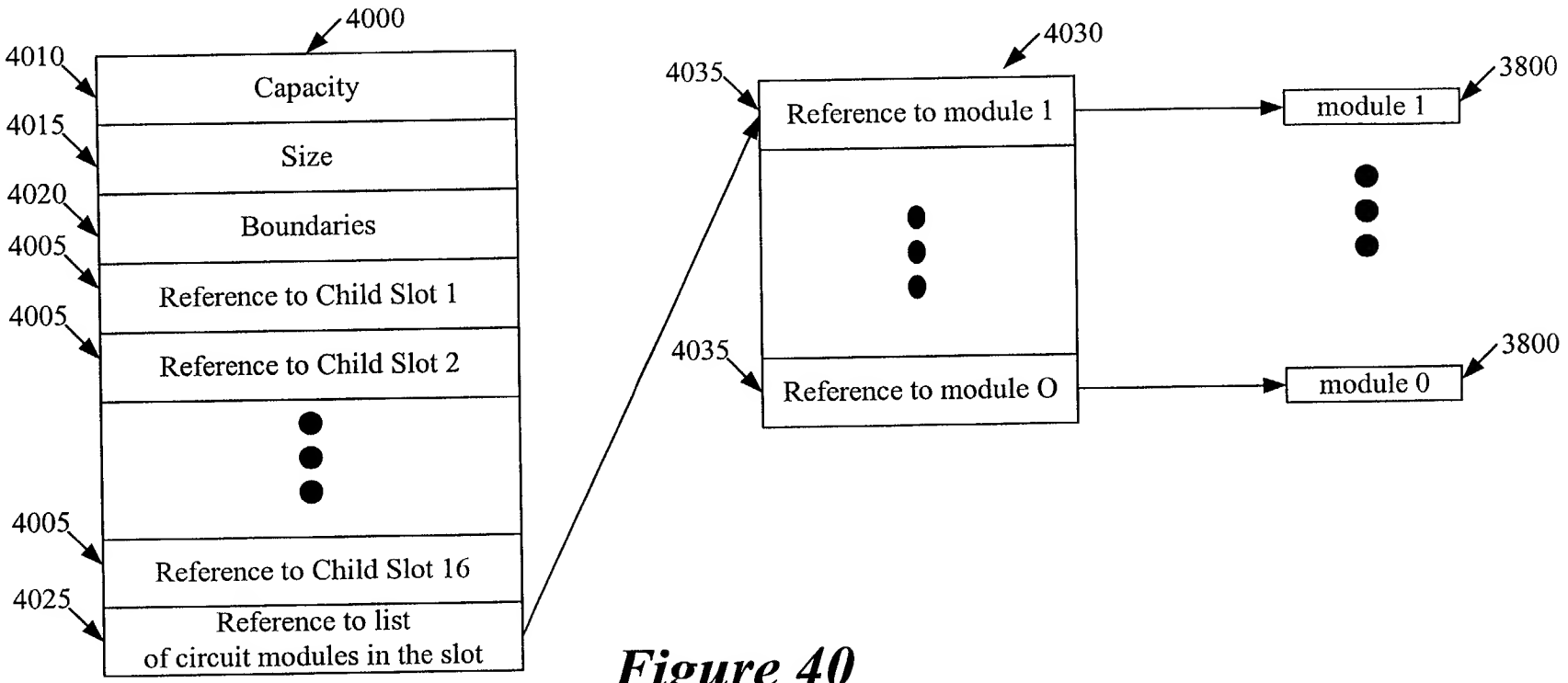

Figure 40

4300

Data Structure = $[\sum_{net} F(netconfig, path1), \sum_{net} F(netconfig, path2), \sum_{net} F(netconfig, path3), \bullet\bullet\bullet \sum_{net} F(netconfig, path42)]$

Figure 43

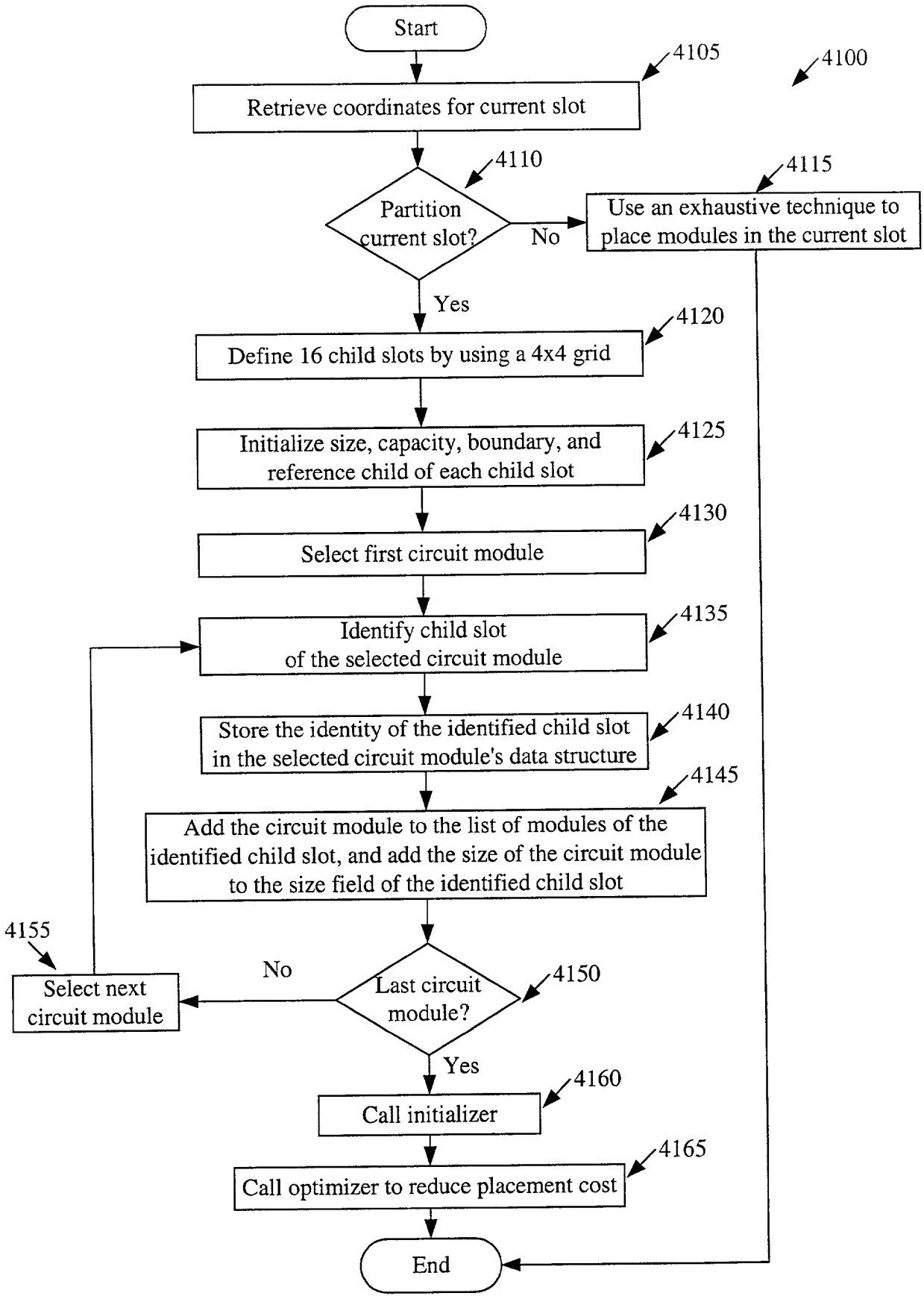
Start
4105
4100
Retrieve coordinates for current slot
4110
4115
Partition current slot?
No
Use an exhaustive technique to place modules in the current slot
Yes
4120
Define 16 child slots by using a 4x4 grid
4125
Initialize size, capacity, boundary, and reference child of each child slot
4130
Select first circuit module
4135
Identify child slot of the selected circuit module
4140
Store the identity of the identified child slot in the selected circuit module's data structure
4145
Add the circuit module to the list of modules of the identified child slot, and add the size of the circuit module to the size field of the identified child slot
4155
Select next circuit module
No
Last circuit module?
4150
Yes
4160
Call initializer
4165
Call optimizer to reduce placement cost
End

Figure 41

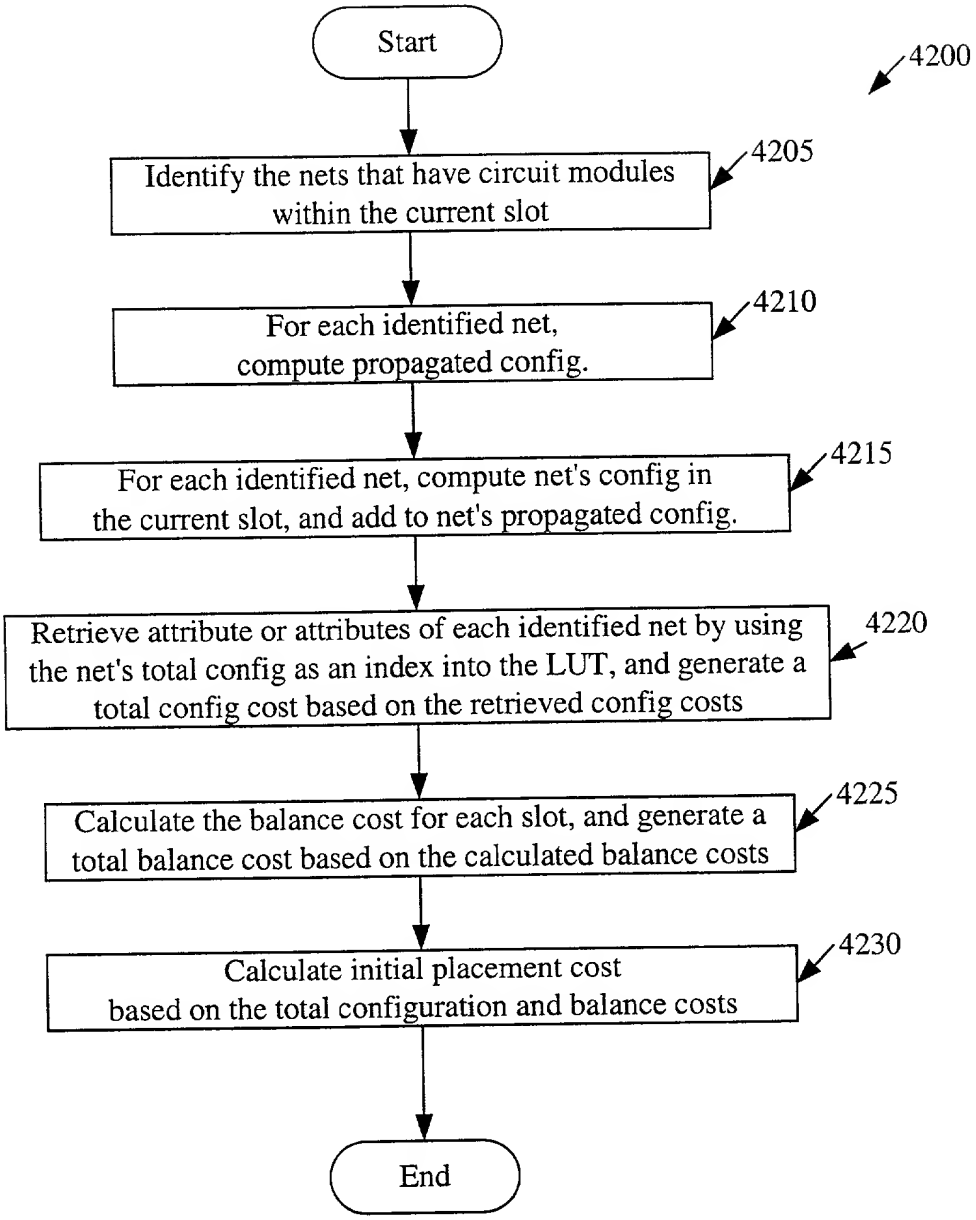
Start
4200
Identify the nets that have circuit modules within the current slot
4205
For each identified net, compute propagated config.
4210
For each identified net, compute net's config in the current slot, and add to net's propagated config.
4215
Retrieve attribute or attributes of each identified net by using the net's total config as an index into the LUT, and generate a total config cost based on the retrieved config costs
4220
Calculate the balance cost for each slot, and generate a total balance cost based on the calculated balance costs
4225
Calculate initial placement cost based on the total configuration and balance costs
4230
End

Figure 42

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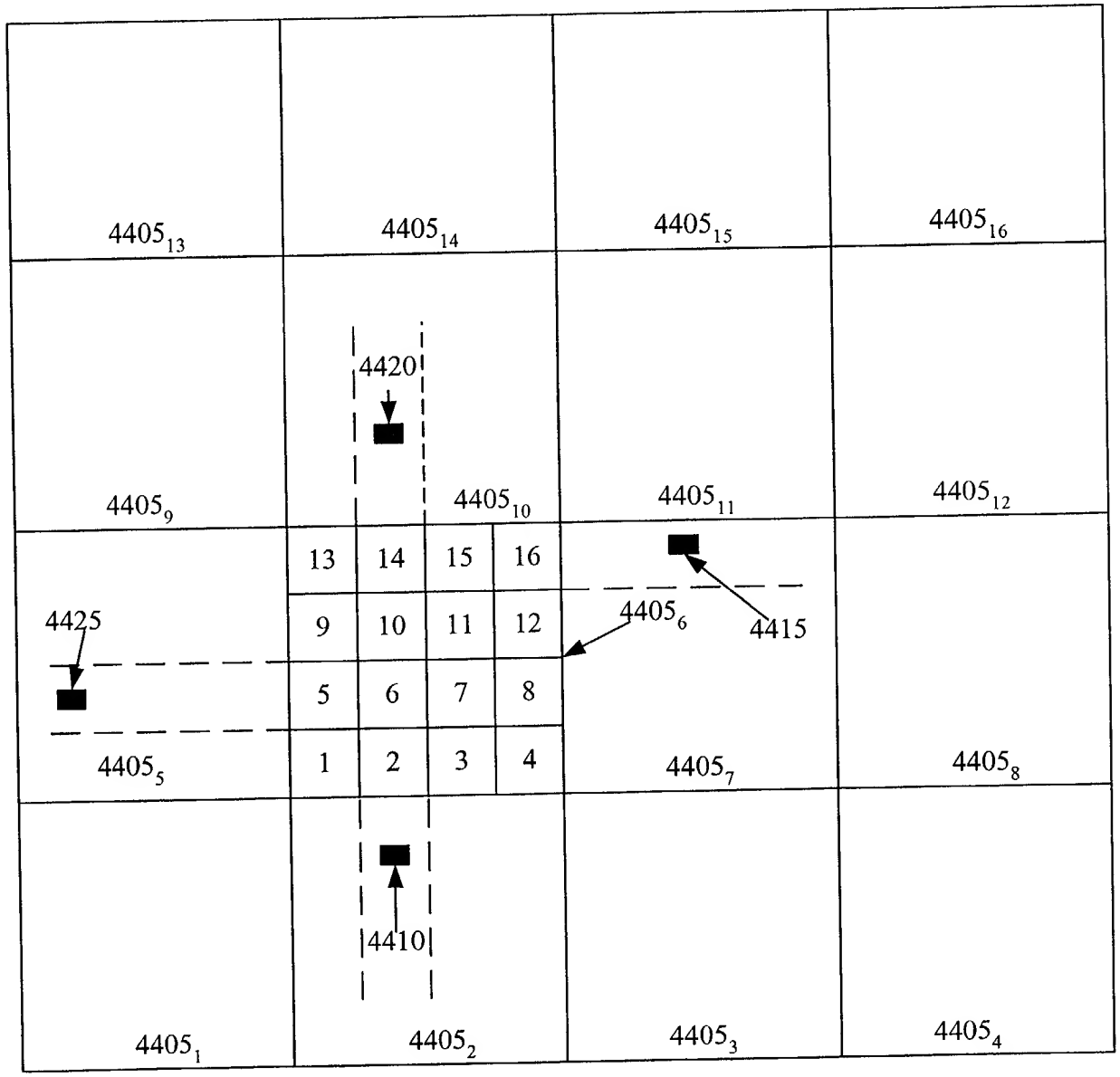

Figure 44

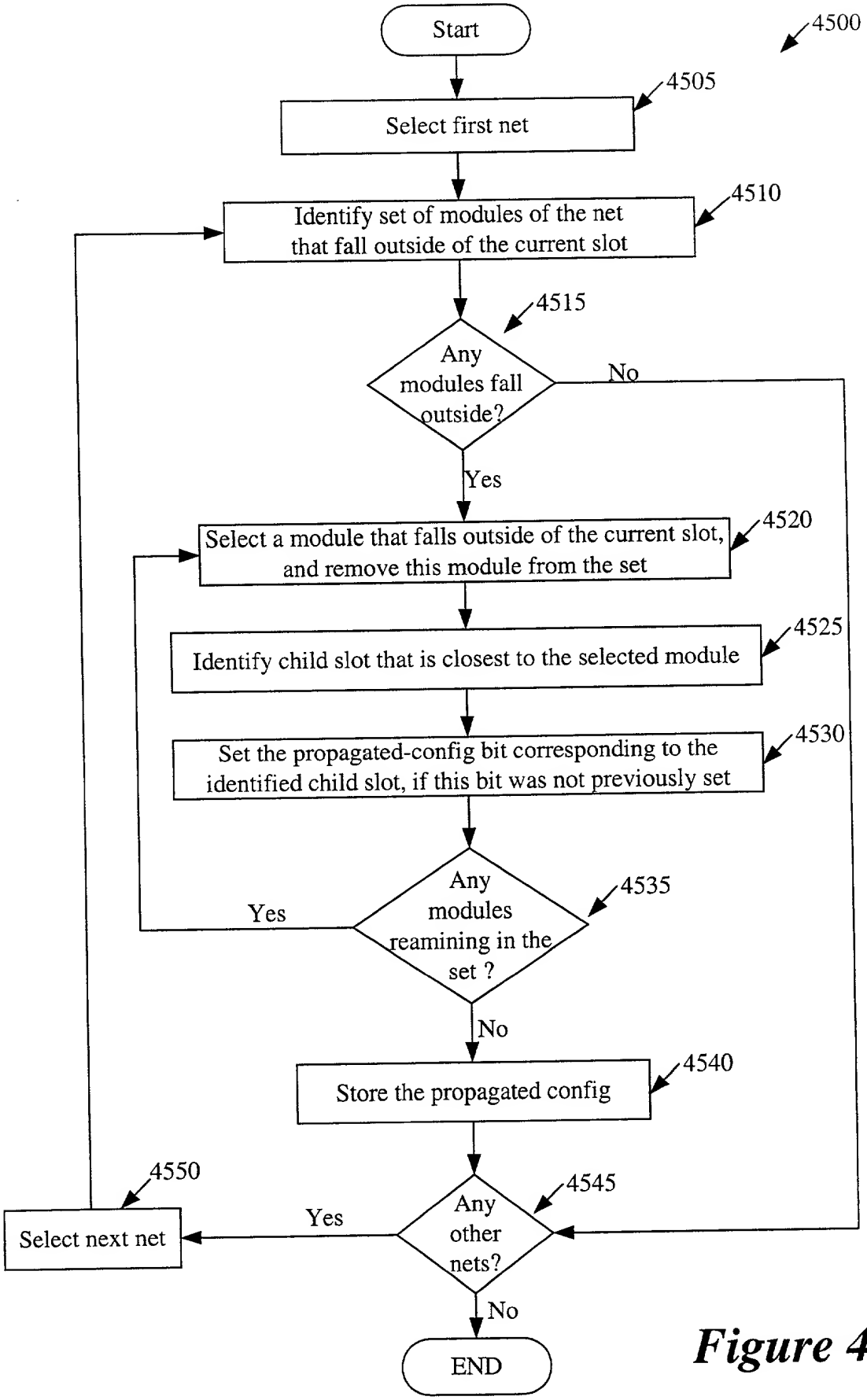
Start
4500
4505
Select first net
4510
Identify set of modules of the net that fall outside of the current slot
4515
Any modules fall outside?
No
Yes
4520
Select a module that falls outside of the current slot, and remove this module from the set
4525
Identify child slot that is closest to the selected module
4530
Set the propagated-config bit corresponding to the identified child slot, if this bit was not previously set
4535
Any modules reamining in the set ?
Yes
No
4540
Store the propagated config
4545
Any other nets?
Yes
4550
Select next net
No
END

Figure 45

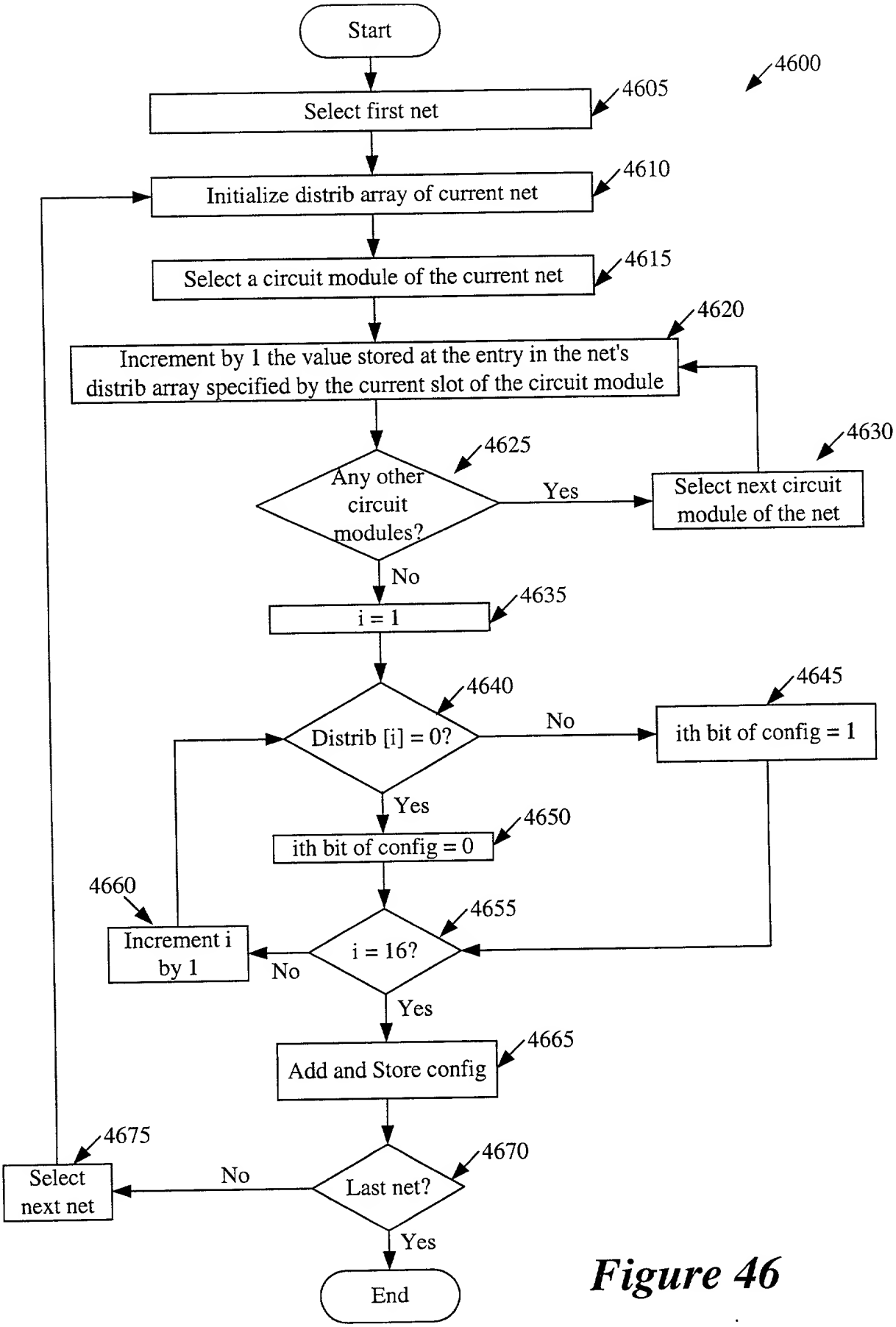
Start
4600
Select first net
4605
Initialize distrib array of current net
4610
Select a circuit module of the current net
4615
Increment by 1 the value stored at the entry in the net's distrib array specified by the current slot of the circuit module
4620
Any other circuit modules?
4625
Yes
Select next circuit module of the net
4630
No
i = 1
4635
Distrib [i] = 0?
4640
No
ith bit of config = 1
4645
Yes
ith bit of config = 0
4650
4660
Increment i by 1
i = 16?
4655
No
Yes
Add and Store config
4665
4675
Select next net
No
Last net?
4670
Yes
End

Figure 46

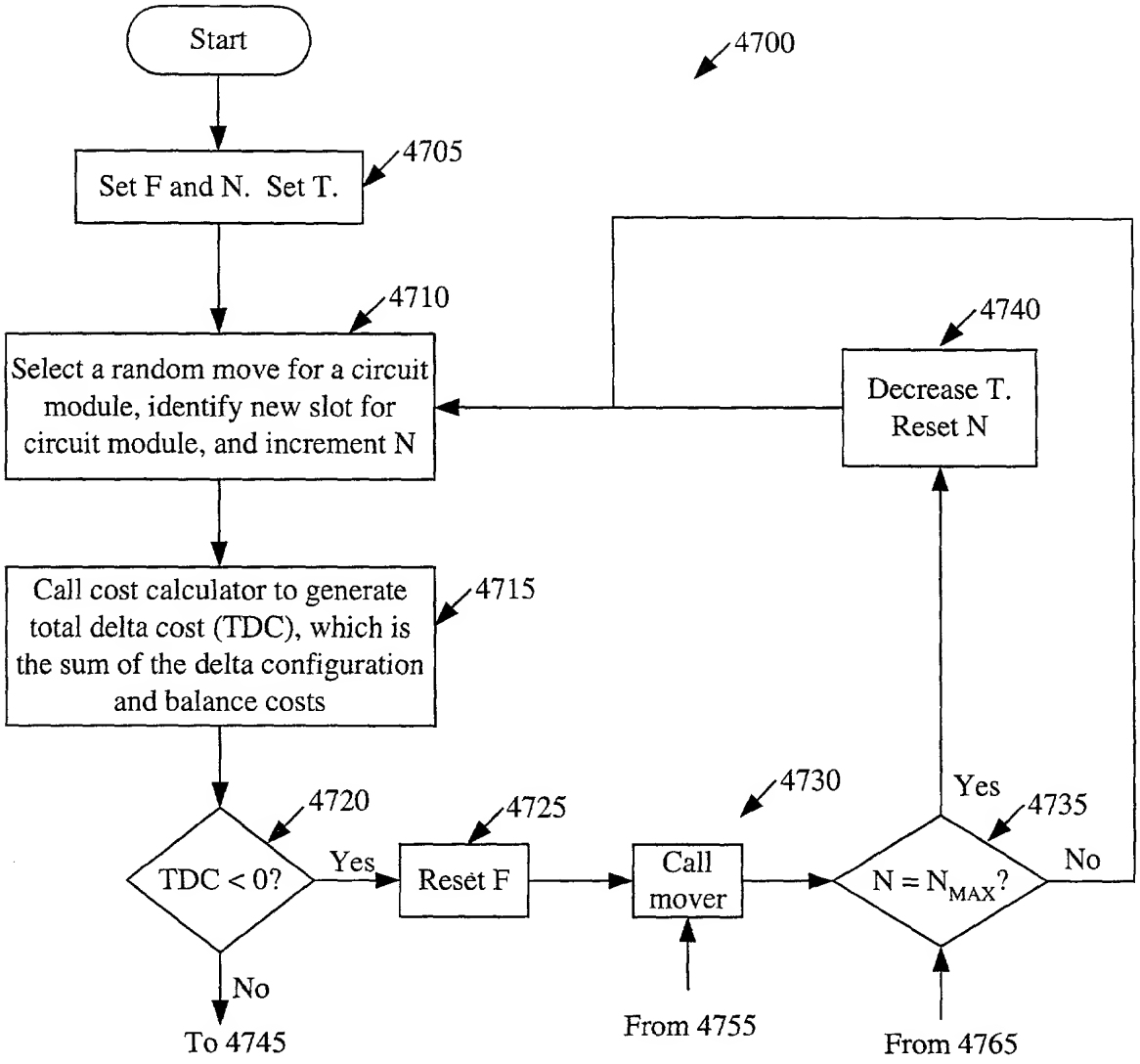

Figure 47A

Figure 47: ***Figure 47A*** / ***Figure 47B***

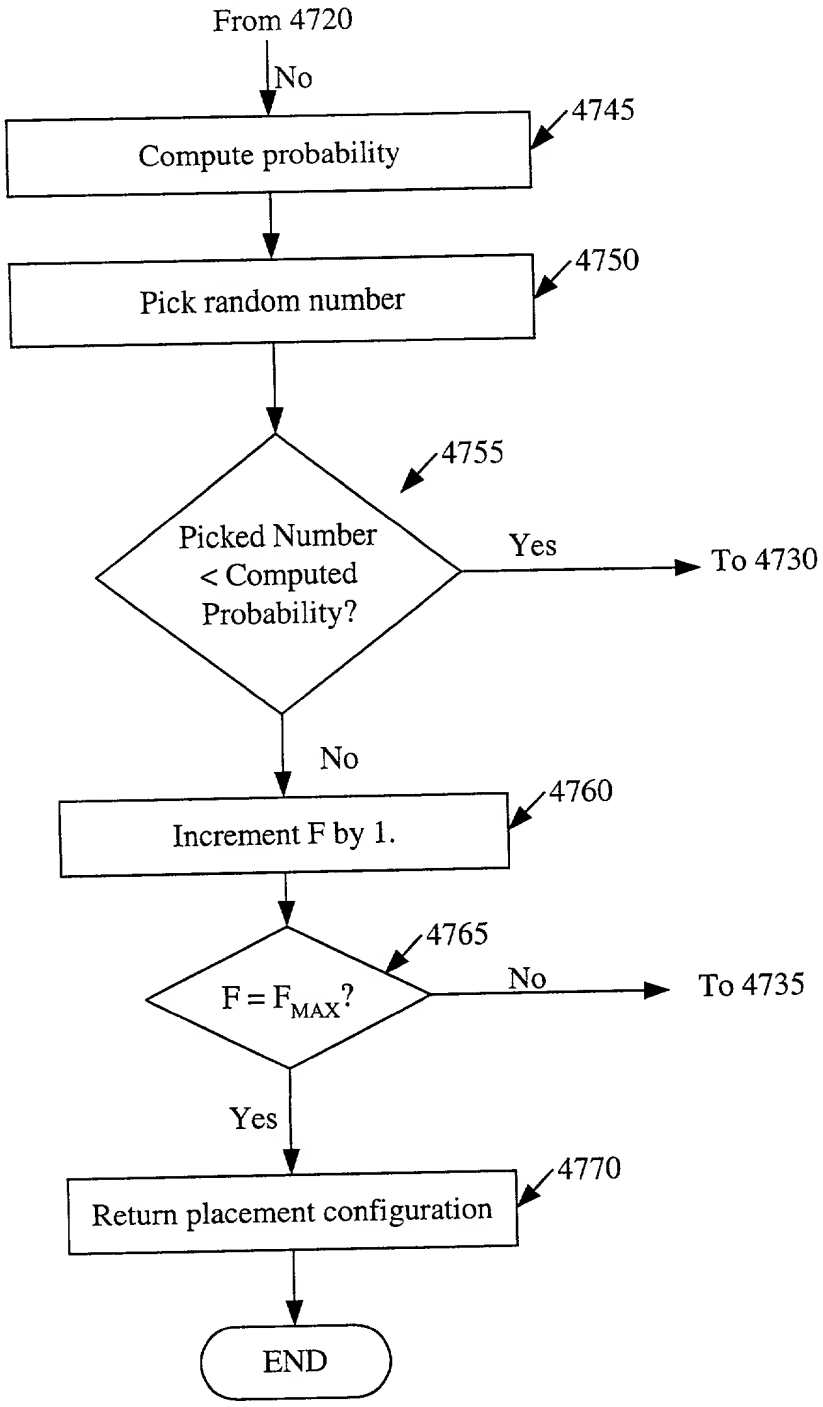
From 4720
No
Compute probability
4745
Pick random number
4750
4755
Picked Number < Computed Probability?
Yes
To 4730
No
Increment F by 1.
4760
4765
F = F_MAX?
No
To 4735
Yes
Return placement configuration
4770
END

Figure 47B

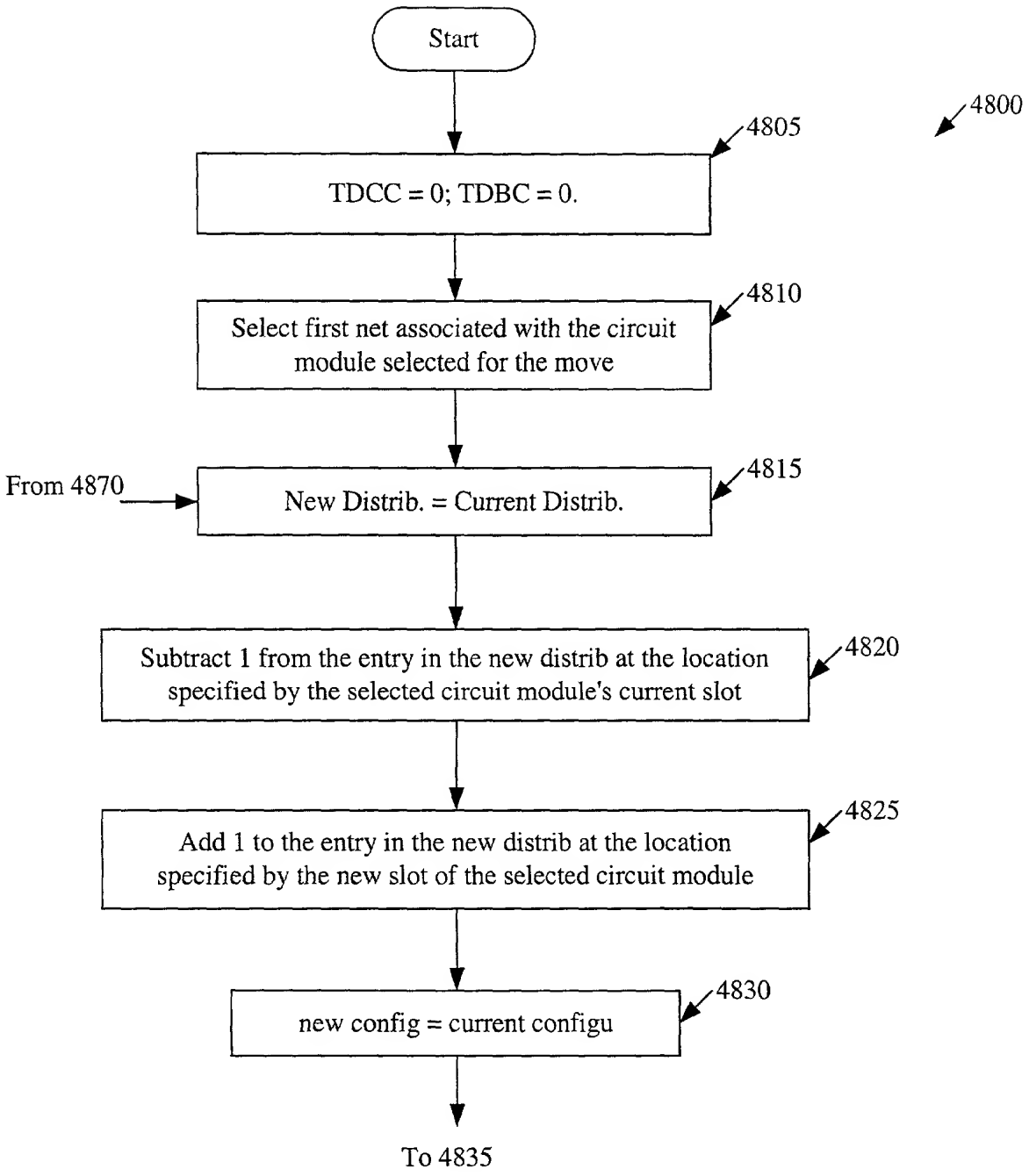

Figure 48A

Figure 48: ***Figure 48A*** / ***Figure 48B***

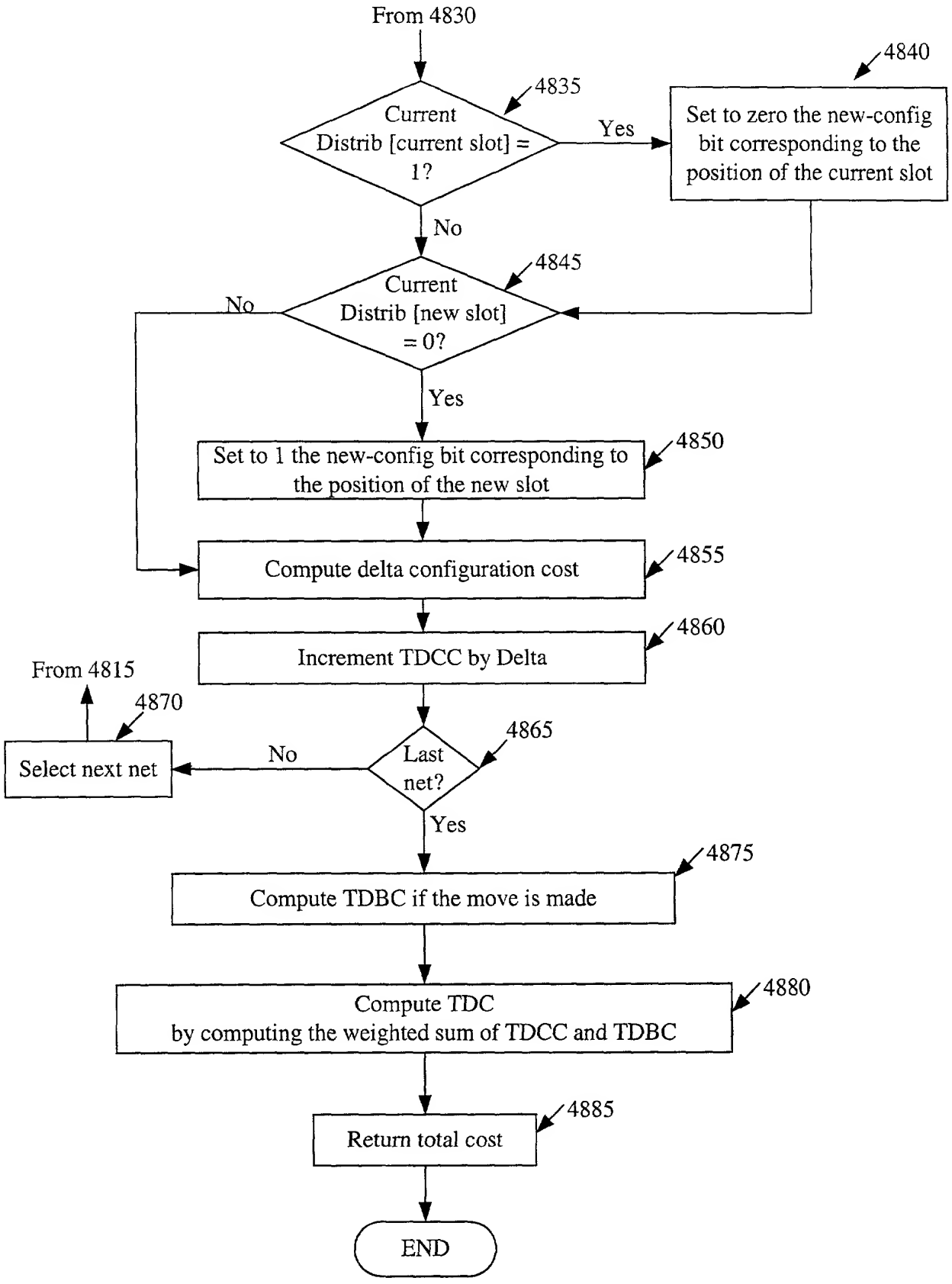
From 4830
4835
Current Distrib [current slot] = 1?
Yes
4840
Set to zero the new-config bit corresponding to the position of the current slot
No
4845
Current Distrib [new slot] = 0?
No
Yes
Set to 1 the new-config bit corresponding to the position of the new slot
4850
Compute delta configuration cost
4855
Increment TDCC by Delta
4860
From 4815
4870
Select next net
No
4865
Last net?
Yes
Compute TDBC if the move is made
4875
Compute TDC by computing the weighted sum of TDCC and TDBC
4880
Return total cost
4885
END

Figure 48B

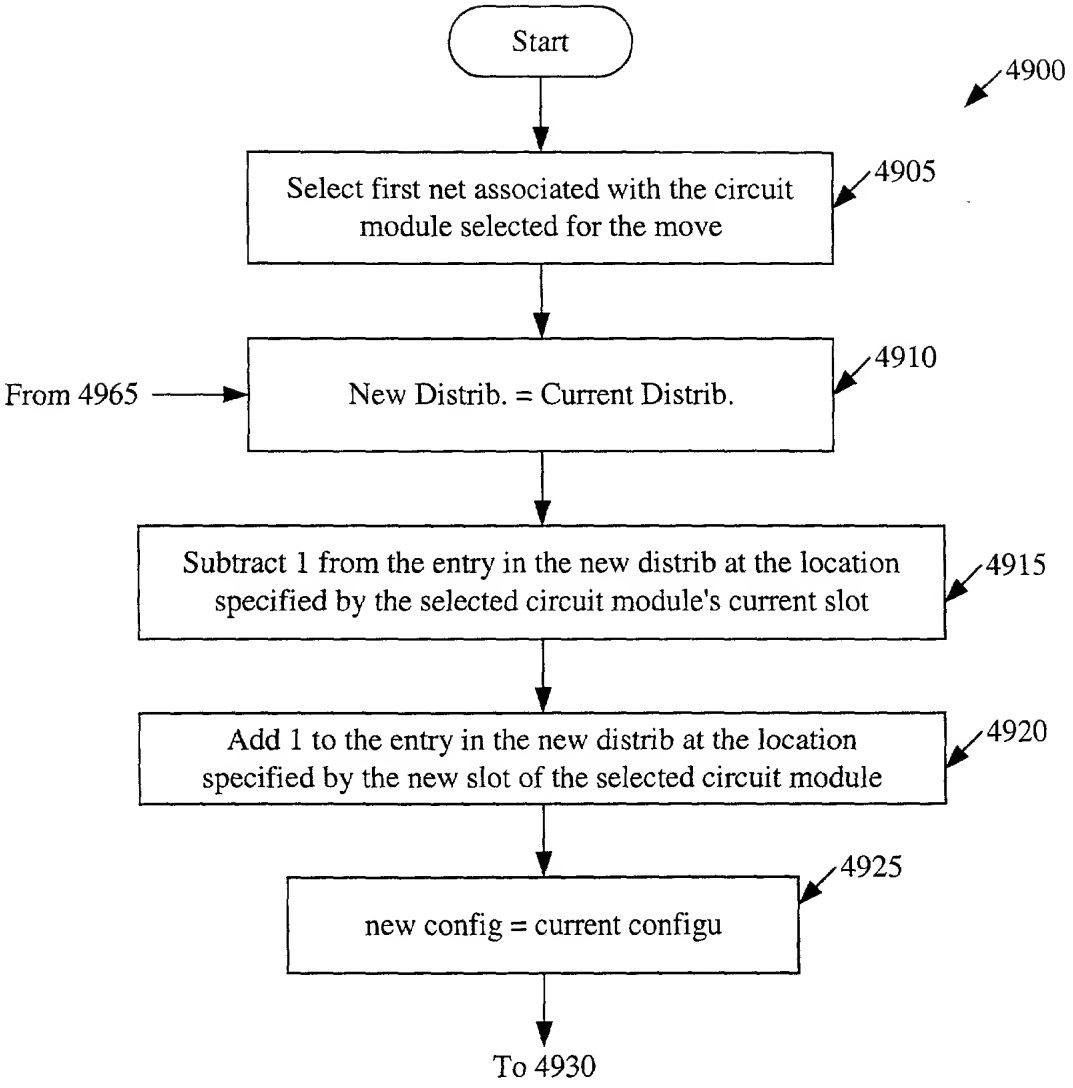

Figure 49A

Figure 49: ***Figure 49A*** / ***Figure 49B***

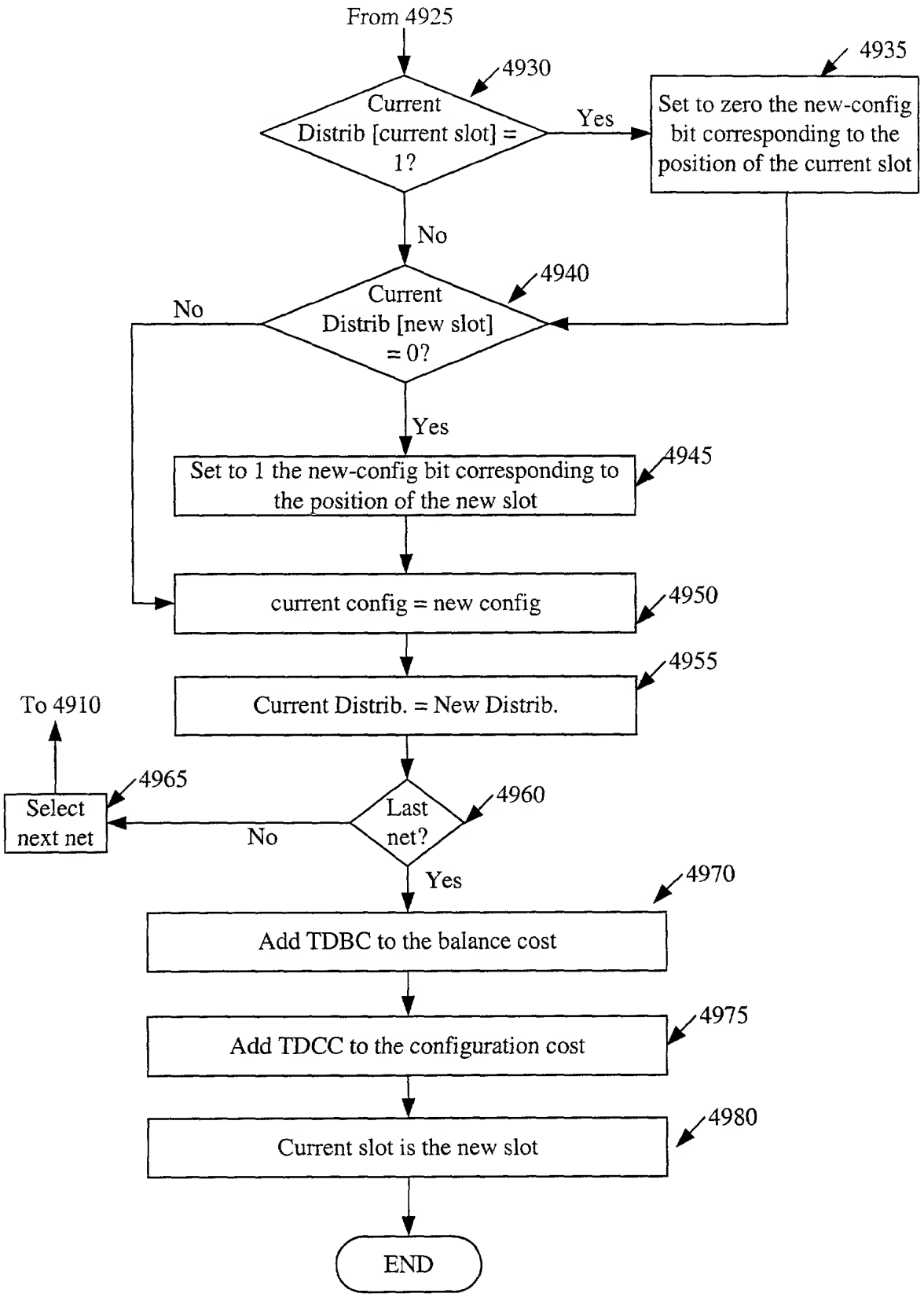
From 4925
4930
Current Distrib [current slot] = 1?
Yes
4935
Set to zero the new-config bit corresponding to the position of the current slot
No
4940
Current Distrib [new slot] = 0?
No
Yes
Set to 1 the new-config bit corresponding to the position of the new slot
4945
current config = new config
4950
Current Distrib. = New Distrib.
4955
To 4910
4965
Select next net
No
Last net?
4960
Yes
4970
Add TDBC to the balance cost
Add TDCC to the configuration cost
4975
Current slot is the new slot
4980
END

Figure 49B

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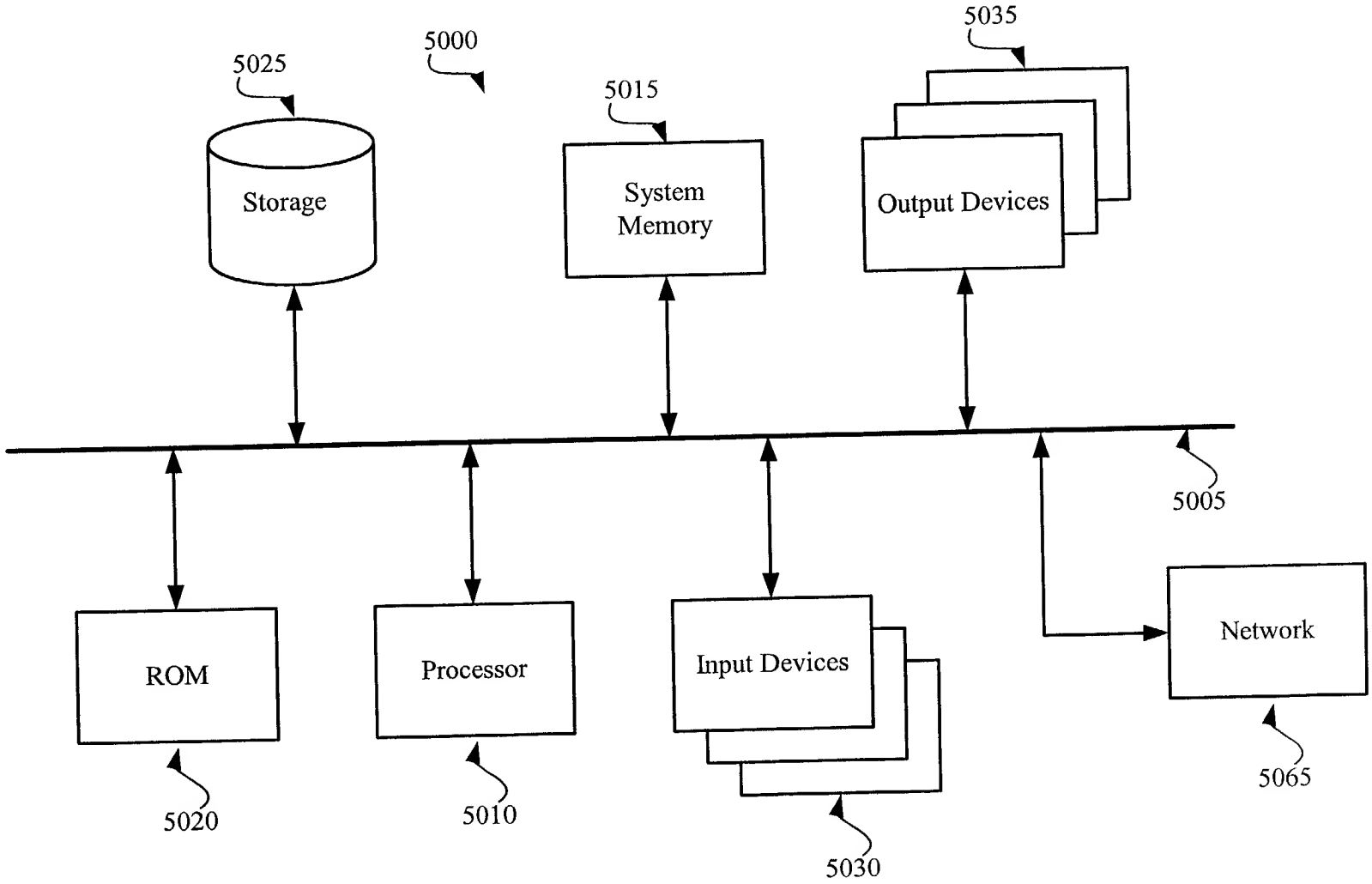

Figure 50